

**Technical training.**  
Product information.

## **I01 General Vehicle Electronics**



**BMW Service**

Edited for the U.S. market by:

**BMW Group University**  
**Technical Training**

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# General information

## Symbols used

The following symbol is used in this document to facilitate better comprehension or to draw attention to very important information:



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Contains important safety information and information that needs to be observed strictly in order to guarantee the smooth operation of the system.

---

## Information status and national-market versions

BMW Group vehicles meet the requirements of the highest safety and quality standards. Changes in requirements for environmental protection, customer benefits and design render necessary continuous development of systems and components. Consequently, there may be discrepancies between the contents of this document and the vehicles available in the training course.

This document basically relates to the European version of left-hand drive vehicles. Some operating elements or components are arranged differently in right-hand drive vehicles than shown in the graphics in this document. Further differences may arise as a result of the equipment specification in specific markets or countries.

## Additional sources of information

Further information on the individual topics can be found in the following:

- Owner's Handbook
- Integrated Service Technical Application.

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The information contained in this document forms an integral part of the technical training of the BMW Group and is intended for the trainer and participants in the seminar. Refer to the latest relevant information systems of the BMW Group for any changes/additions to the technical data.

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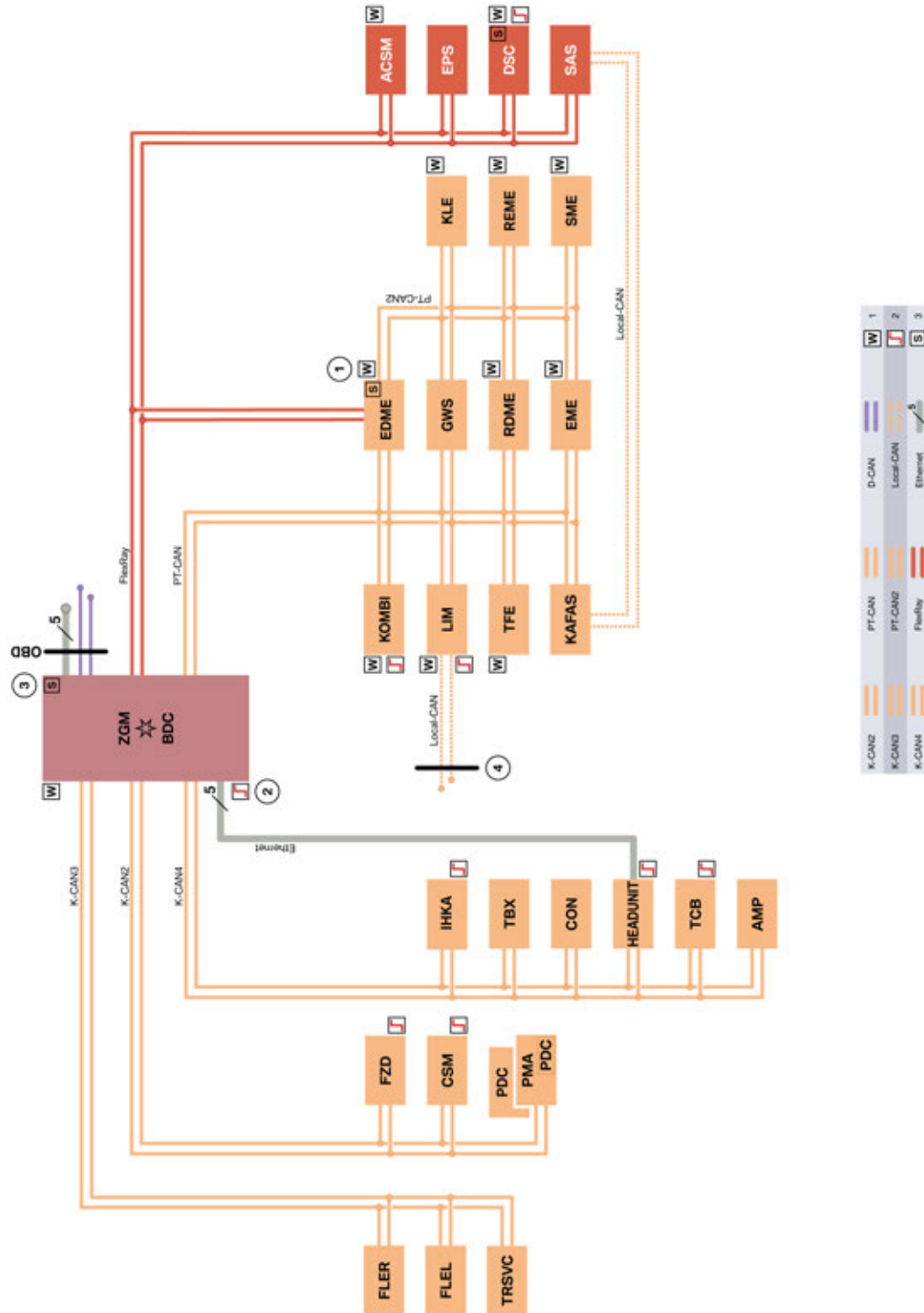
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## 1. Vehicle Electrical System

### 1.1. Bus overview



I01 bus overview

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## 1. Vehicle Electrical System

<b>Index</b>	<b>Explanation</b>
ACSM	Crash Safety Module
AMP	Amplifier
BDC	Body Domain Controller
CON	Controller
CSM	Car Sharing Module
DSC	Dynamic Stability Control
EDME	Electrical Digital Motor Electronics
EME	Electrical Machine Electronics
EPS	Electronic Power Steering
FLER	Frontal Light Electronics Right
FLEL	Frontal Light Electronics Left
FZD	Roof function center
GWS	Gear selector switch
HEADUNIT	Headunit
IHKA	Integrated automatic heating / air-conditioning system
KAFAS	Camera-based driver support systems
KLE	Convenience charging electronics
KOMBI	Instrument cluster
LIM	Charging interface module
PDC	Park Distance Control
PMA	Parking Maneuvering Assistant
RDME	Range Extender Digital Engine Electronics
REME	Range Extender Electrical Machine Electronics
SAS	Optional equipment system
SME	Battery management electronics
TFE	Hybrid pressure refueling electronic control unit
TBX	Touchbox
TCB	Telematic Communication Box
TRSVCA	Top Rear Side View Camera
ZGM	Central gateway module
1	Control units also connected at terminal 15WUP
2	Control units with wake-up authorization
3	Start-up node control units for starting and synchronizing the FlexRay bus system
4	Charging socket at the vehicle



# **I01 General Vehicle Electronics**

## **1. Vehicle Electrical System**

All bus systems in the I01 are known from the other F-series.

There is no MOST in the I01.

### **1.2. Main bus systems**

#### **1.2.1. K-CAN**

In the I01 the following K-CAN are used:

- K-CAN2
- K-CAN3
- K-CAN4.

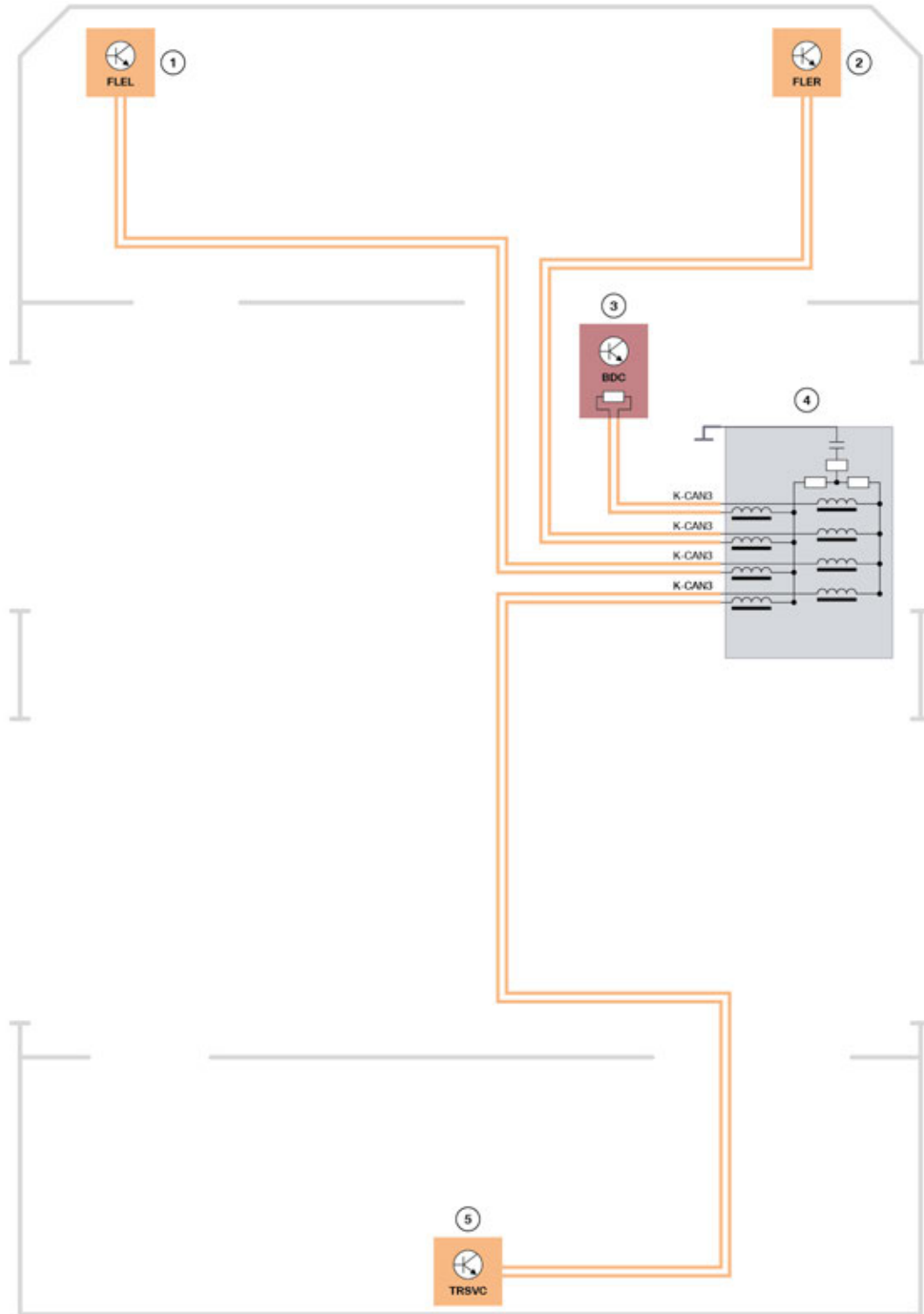
All K-CAN data buses have a data transfer rate of 500 kBit/s.

The K-CAN with 100 kBit/s data transfer rate is not used in the I01.

# I01 General Vehicle Electronics

## 1. Vehicle Electrical System

### K-Can termination



System wiring diagram K-CAN3

TE13-0114

# I01 General Vehicle Electronics

## 1. Vehicle Electrical System

Index	Explanation
1	Frontal Light Electronics Left (FLEL)
2	Frontal Light Electronics Right (FLER)
3	Body Domain Controller (BDC)
4	CAN terminator
5	Top Rear Side View Camera (TR SVC)

The CAN-Buses are shown in the overview of the bus systems. The actual physical layout (topology) is shown using the example of the K-CAN3.

As with most bus systems terminating resistors are also used for termination for the K-CAN to avoid reflections on the data lines.

The terminating resistors for the termination are located in the

- Body Domain Controller
- and CAN terminator.

All other control units are connected at the CAN terminator without a terminating resistor.

### CAN terminator

In the CAN terminator the terminating resistor for the corresponding CAN-Bus is installed. The terminating resistor comprises two resistances connected in series, each 60 Ohm. A measuring tap against ground with a resistor and capacitor for the reduction of high-frequency faults is also installed. Ferrite beads are installed for all bus lines in the CAN terminator. Ferrite beads suppress high-frequency faults on the CAN data lines, thus making possible line lengths of up to 5 m in the wiring harness.

### 1.2.2. PT-CAN

In the I01 the following PT-CAN are used:

- PT-CAN
- PT-CAN2.

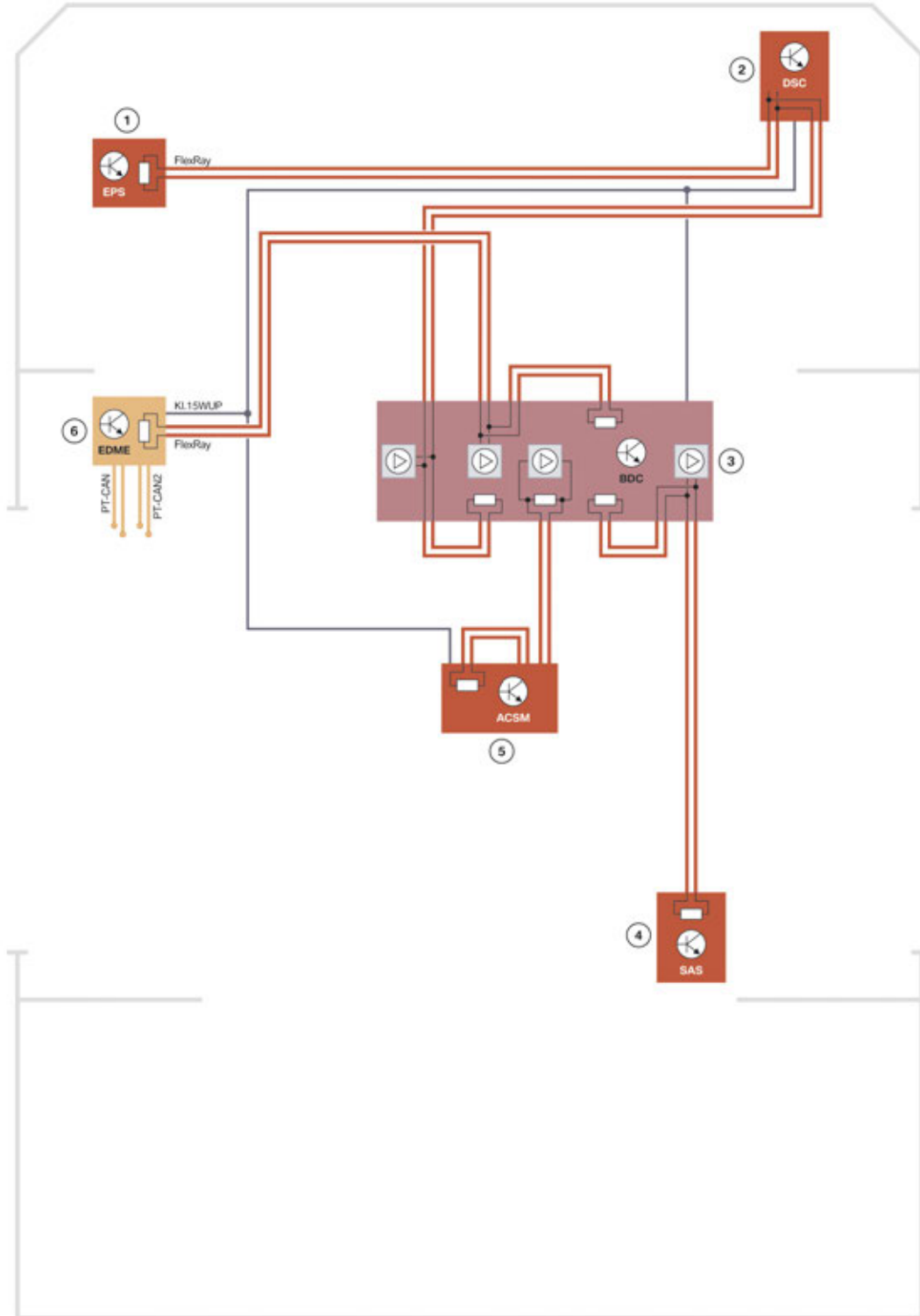
The gateway for the PT-CAN2 is located in the Electrical Digital Motor Electronics (EDME).

Both PT-CAN data buses have a data transfer rate of 500 kBit/s.

# I01 General Vehicle Electronics

## 1. Vehicle Electrical System

### 1.2.3. FlexRay



System wiring diagram for FlexRay

TE12-1073

# I01 General Vehicle Electronics

## 1. Vehicle Electrical System

Index	Explanation
1	Electronic Power Steering (EPS)
2	Dynamic Stability Control (DSC)
3	Body Domain Controller (BDC)
4	Optional equipment system (SAS)
5	Crash Safety Module (ACSM)
6	Electrical Digital Motor Electronics (EDME)

The FlexRay is shown in a simplified form in the overview of the bus systems. The FlexRay system wiring diagram shows the actual physical layout (topology).

The FlexRay has a data transfer rate of 10 MBit/s.

The control units at the FlexRay are:

- connected using an additional line at terminal 15WUP
- or terminal 15N.

### FlexRay data bus topology for the I01

The star coupler with four drivers is located in the Body Domain Controller (BDC). The FlexRay control units are connected to these bus drivers independent of their termination type.

### Bus termination

As with most bus systems resistors are also used for termination for the FlexRay to avoid reflections on the data lines at both ends of the data lines. The terminating resistors are located in the control units. If only one control unit is connected at a bus driver, the connections at the bus driver and at the control unit also have a terminating resistor.

### Synchronization

In order to realize the synchronous design of individual functions in networked control units, a common time base is required. As all control units work internally with their own clock generator, the time synchronization must be done via the data bus. The control units measure the period of certain synchronization bits, calculate the mean value and adapt their bus cycle to this value. The synchronization bits are sent in the static part of the bus message. The synchronization starts in the FlexRay after the system start between two control units that are authorised to perform wake-up function (marked with "S" in the bus overview), once the Body Domain Controller has sent a wake-up pulse. When this process is completed, the other control units log on at the FlexRay and calculate their respective difference value. In addition, a mathematical correction of the synchronization is done during operation. It is thus guaranteed that even the slightest time differences do not lead to transmission errors over a longer period.

### 1.2.4. D-CAN

The D-CAN for the vehicle diagnosis has a data transfer rate of 500 kBit/s.

# **I01 General Vehicle Electronics**

## **1. Vehicle Electrical System**

### **1.2.5. Ethernet**

The Ethernet access is used for programming the entire vehicle.

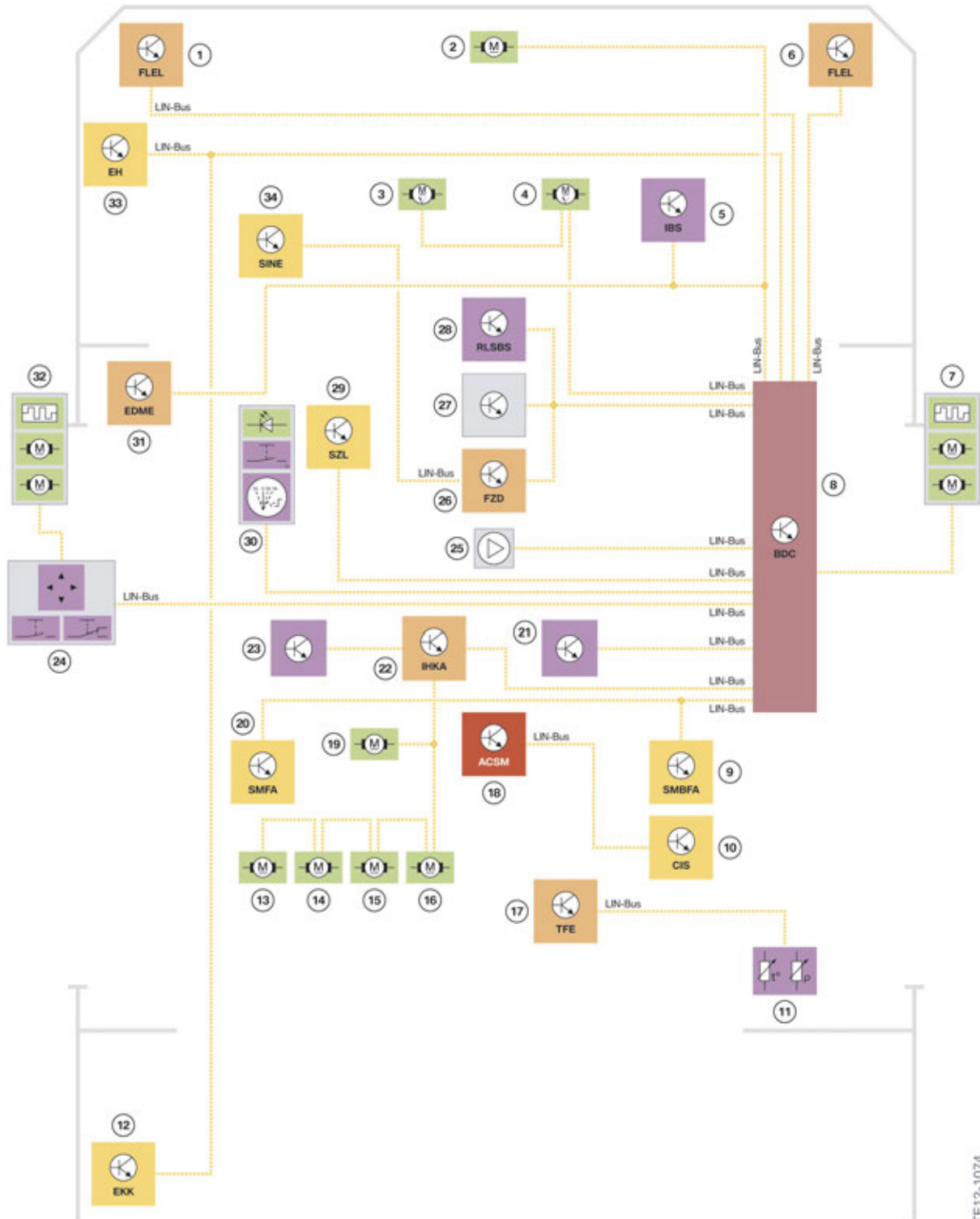
In a I01 with Headunit High the map update for the navigation is also done using the Ethernet interface.

# I01 General Vehicle Electronics

## 1. Vehicle Electrical System

### 1.3. Sub-bus systems

#### 1.3.1. LIN-Bus



Overview of local interconnect network bus

TE12-1074

# I01 General Vehicle Electronics

## 1. Vehicle Electrical System

Index	Explanation
1	Frontal Light Electronics Left
2	Electric fan
3	Wiper motor, passenger's side
4	Wiper motor, driver's side
5	Intelligent battery sensor
6	Frontal Light Electronics Right
7	Right exterior mirror
8	Body Domain Controller
9	Front passenger seat module
10	Seat occupancy mat
11	Pressure/Temperature sensor
12	Electric A/C compressor
13	Stepper motor, footwell
14	Stepper motor, blending flap
15	Stepper motor, defrost
16	Stepper motor, fresh air/air recirculation function
17	Hybrid pressure refueling electronic control unit
18	Crash Safety Module
19	Blower output stage
20	Driver's seat module
21	Intelligent Safety button
22	Integrated automatic heating / air-conditioning system or integrated heating / air-conditioning regulation
23	Control panel for heating/air-conditioning and control panel for radio
24	Switch block, driver's door
25	Remote control receiver
26	Roof function center
27	Interior rear-view mirror with automatic anti-dazzle function
28	Rain-light-solar-condensation sensor
29	Steering column switch cluster
30	Operating facility, light switch
31	Electrical Digital Motor Electronics
32	Left exterior mirror
33	Electric heating
34	Siren with tilt alarm sensor



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## 1. Vehicle Electrical System

Different data rates are used for the local interconnect network bus according to the information required. The data transfer rates of the local interconnect network bus in the I01 range from 9.6 kBit/s to 20.0 kBit/s.

Examples:

- 9.6 kBit/s exterior mirror, switch block at driver's door
- 19.2 kBit/s FLEL, FLER
- 20.0 kBit/s remote control receiver.

The Body Domain Controller is designed for the different data rates at the corresponding inputs.

### 1.3.2. Local CAN

In the I01 the following Local Controller Area Networks are available with the corresponding equipment:

- Local Controller Area Network from the optional equipment system to camera-based driver support systems (KAFAS)
- Local Controller Area Network from the charging interface module LIM to the charging socket at the vehicle.

The Local Controller Area Networks have a data transfer rate of 500 kBit/s.

### 1.3.3. USB

Depending on the equipment the following USB connections are possible:

- from the headunit to the Telematic Communication Box (TCB)
- from the headunit to the telephone base plate
- from the headunit to the USB plug.

In vehicles with a Car Sharing Module the CSM is supplied with power via the telephone base plate.

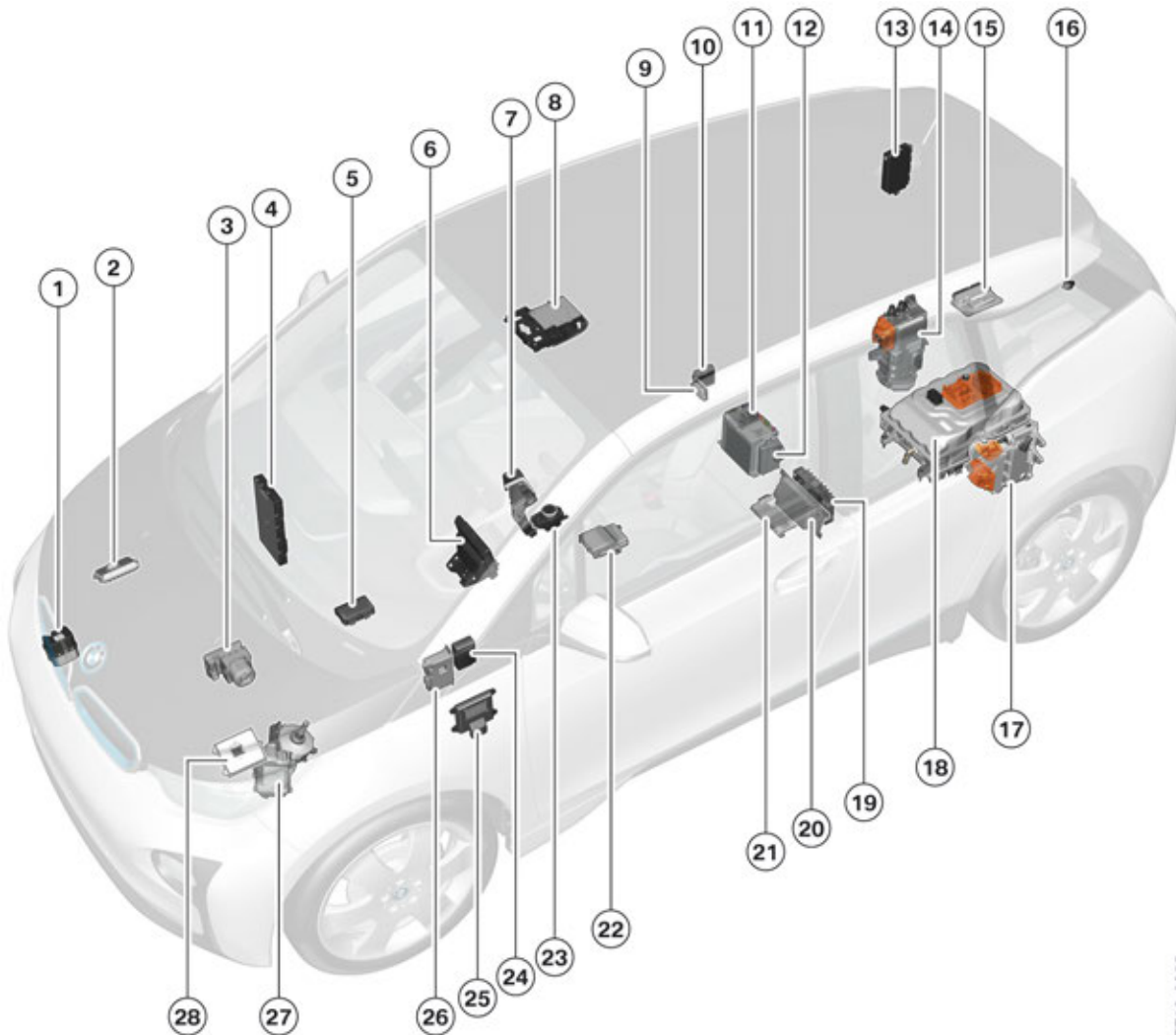
## 1.4. Diagnosis access OBD2

The vehicle diagnosis via D-CAN is done using the OBD2 interface. The Ethernet access for the vehicle programming is also located in the OBD2 interface.

# I01 General Vehicle Electronics

## 1. Vehicle Electrical System

### 1.5. Installation locations of control units



TE12-0935

Installation locations of control units

Index	Explanation
1	Vehicle Sound Generator (VSG) (Not currently for the US market)
2	Frontal Light Electronics Rights (FLER)
3	Dynamic Stability Control (DSC)
4	Body Domain Controller (BDC)
5	Integrated automatic heating / air-conditioning system (IHKA) (IHKR is not available for the US Market)
6	Instrument cluster (KOMBI)
7	Gear selector switch (GWS)
8	Roof function center (FZD)

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## 1. Vehicle Electrical System

Index	Explanation
9	Touchbox (TBX)
10	Parking Maneuvering Assistant (PMA) or Park Distance Control (PDC)
11	Headunit (HEADUNIT)
12	Optional equipment system (SAS)
13	Charging interface module (LIM)
14	Range Extender Electrical Machine Electronics (REME)
15	Range Extender Digital Engine Electronics (RDME)
16	Top Rear Side View Camera (TRSVK)
17	Convenience charging electronics (KLE)
18	Electrical machine electronics (EME)
19	Amplifier (AMP)
20	Telematic Communication Box (TCB)
21	Battery management electronics (SME)
22	Crash Safety Module (ACSM)
23	Controller (CON)
24	Hybrid pressure refueling electronic control unit (TFE)
25	Electrical Digital Motor Electronics (EDME)
26	Camera-based driver support systems (KAFAS)
27	Electronic Power Steering (EPS)
28	Frontal Light Electronics Left (FLEL)

The Car Sharing Module is connected to the base plate of the eject box instead of a snap-in adapter.

### 1.6. Control units

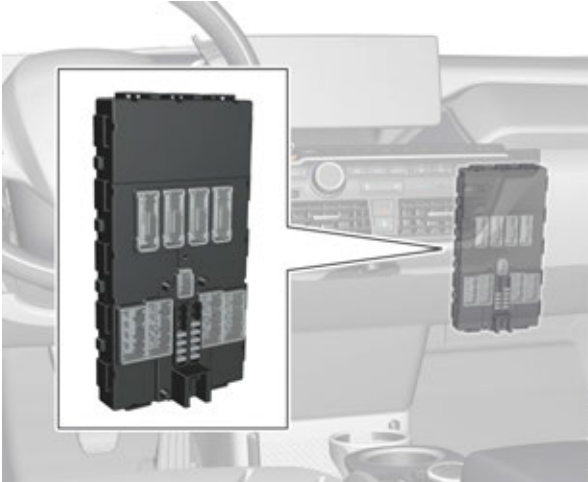
Information on control units

- which are used for the first time in the I01
- known control units, which are adapted for the I01.

# I01 General Vehicle Electronics

## 1. Vehicle Electrical System

### 1.6.1. Body Domain Controller



Body Domain Controller

The Body Domain Controller (BDC) replaces the control units known from the F30:

- Front Electronic Module (FEM) and
- Rear Electronic Module (REM).

#### **BDC functions**

The Body Domain Controller (BDC) is responsible for the following functions:

- Gateway
- Electronic immobilizer
- Terminal control
- Comfort Access
- Central locking system
- Power Window Regulator
- Lighting
- Wash/wipe system
- Horn

Other functions:

- Vehicle data storage
- Data transfer for Condition Based Service (CBS).

#### **Fuses in the BDC**

The following components are protected by fuses in the BDM:

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## 1. Vehicle Electrical System

- Steering column switch cluster (SZL), operating facility for driver assistance systems, operating facility for lights
- Headlight driver module for LED
- OBD2 socket, IHKA
- Outside door handle electronics
- Power Window Regulator
- Central locking system
- Heated rear window.

### Relay in the BDC

The following components are switched by a relay in the BDC:

- Power window regulators
- Central locking system
- Headlight cleaning system
- Rear wiper.

### Activation of relay

The following relays are activated by the BDC:

- Heated rear window
- Horn

The relays are located above the power distribution box in the passenger compartment.

### Gateway in the BDC

The central gateway module ZGM is integrated in the BDC. The ZGM is integrated as a module in the BDC in the electrical system architecture 2020. It is viewed as a control unit within a control unit, in that the ZGM in the BDC behaves like an autarkic control unit. The task of the ZGM is to connect all the data bus systems to each other. By connecting them in this way, it is possible to use information from the individual bus systems on a generalized level. The central gateway module is able to implement different protocols and speeds on other bus systems. The programming data for the control units are transmitted by Ethernet to the vehicle via the ZGM.

### LIN controller in the BDC

The BDC is the gateway for the following components at the local interconnect network bus:

- Frontal Light Electronics Right
- Frontal Light Electronics Left
- Active automatic air flap control
- Exterior mirror, left

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## 1. Vehicle Electrical System

- Exterior mirror, right
- Switch block, driver's door
- Electrical Digital Motor Electronics
- Intelligent battery sensor
- Windscreen wiper
- Rain-Driving light sensor
- Interior rear-view mirror with automatic anti-dazzle function
- Roof function center
- Remote control receiver
- Steering column switch cluster
- Light switch
- Intelligent Safety button
- Seat-heating electronics on driver's side
- Seat-heating electronics on passenger's side

The following Local Interconnect Network components are connected at the BDC, but are only looped through:

- Electric heating
- Electric A/C compressor
- Integrated automatic heating / air-conditioning system or integrated heating / air-conditioning regulation.

### 1.6.2. Frontal Light Electronics (FLEL/FLER)



Frontal Light Electronics Left

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## 1. Vehicle Electrical System

The control units for the Frontal Light Electronics Left (FLEL) and Frontal Light Electronics Right (FLER) are installed in the left and right headlight for the LED headlight equipment.

The Frontal Light Electronics includes:

- The activation of the LED in the corresponding headlight
- The activation of the stepper motor for the headlight beam throw adjustment

The control units FLEL and FLER are connected at the K-CAN3 and at the LIN.

### 1.6.3. Top Rear Side View Camera (TRSVC)



Control unit for reversing camera

The Top Rear Side View Camera (TRSVC) control unit and the actual reversing camera are integrated in the one housing.

In the I01 no Side View cameras are offered.

The TRSVC control unit is connected at the K-CAN3.

### 1.6.4. Roof function center (FZD)



Roof function center

Depending on the vehicle equipment the roof function center (FZD) includes the corresponding components for:

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## 1. Vehicle Electrical System

- Alarm system
- Control of the slide/tilt sunroof.

The FZD is connected at the K-CAN2 and twice at the Local Interconnect Network.

- Local Interconnect Network from FZD to the BDC and
- LIN from FZD to the siren with tilt alarm sensor SINE.

The FZD is not responsible for the control of the interior light. The interior light unit and the FZD electronics are located in the same housing. The control of the interior light is described in chapter 4.

### 1.6.5. Car Sharing Module (CSM)



Car Sharing Module

The Car Sharing Module (CSM) is used in the case of rental cars for access and use of the vehicle.

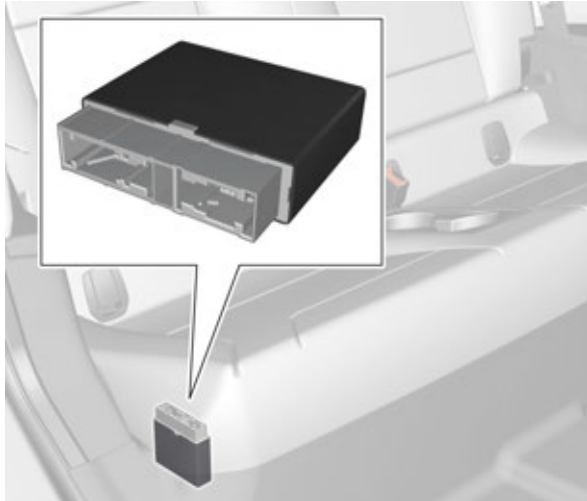
The CSM is connected at the K-CAN2 and via USB at the headunit.



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## 1. Vehicle Electrical System

### 1.6.6. Park Distance Control (PDC)



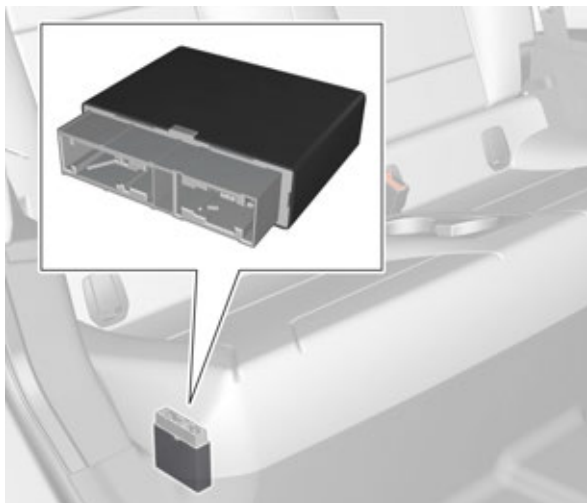
Park Distance Control

Park Distance Control (PDC) assists the driver when manoeuvring in and out of a parking space. The current distance from an obstruction is indicated by acoustic signals and on a visual display.

In vehicles with Parking Maneuvering Assistant (PMA) the sensors of the Park Distance Control (PDC) are evaluated by the Parking Maneuvering Assistant control unit.

The PDC is connected at the K-CAN2.

### 1.6.7. Parking Maneuvering Assistant (PMA)



Parking Maneuvering Assistant

The Parking Maneuvering Assistant facilitates parking in gaps between cars parallel to the roadway.

In a vehicle with PMA all sensors of the Park Distance Control are used. A sensor for the PMA is also available in the bumper panel at the front left and right. Therefore in that case PMA also assumes the entire PDC functions. There is no separate PDC control unit installed.

# I01 General Vehicle Electronics

## 1. Vehicle Electrical System

The PMA is connected at the K-CAN2.

### 1.6.8. Integrated automatic heating / air-conditioning (IHKA)



Integrated automatic heating / air-conditioning

The IHKA is optional equipment for the I01.

The IHKA control unit is a Local Interconnect Network master for the following components of the heating and air-conditioning system:

- Electric heating
- EKK
- Blower output stage
- Flap motors.

The information is also transmitted from the audio control panel via Local Interconnect Network to the IHKA control unit.

The climate control unit transmits the information from the audio control panel via the K-CAN4 to the BDC.

The IHKA is connected at the K-CAN4.

# I01 General Vehicle Electronics

## 1. Vehicle Electrical System

### 1.6.9. Touchbox (TBX)



Touchbox

The Touchbox (TBX) control unit is required for interpreting the contact sensors of the touch controller for the Headunit High.

The TBX is connected at the K-CAN4.

### 1.6.10. Controller with touch pad (CON)



Controller with touch pad

For vehicles with optional equipment SA609 Professional navigation, the regular controller with rotary adjuster/knob is replaced by a touch controller with an additional touch control panel above the rotary adjuster/knob. In the touch control panel the customer can input location information for the navigation system or telephone numbers and contact details. In the map operation the map section for example can be moved and enlarged or reduced by finger movement.

Depending on the national-market version the labeling for navigation differs.

# I01 General Vehicle Electronics

## 1. Vehicle Electrical System

- "NAV" for ECE and USA
- "MAP" for China version.

The controller with touchpad is connected at the K-CAN4.

### 1.6.11. Head unit (HEADUNIT)

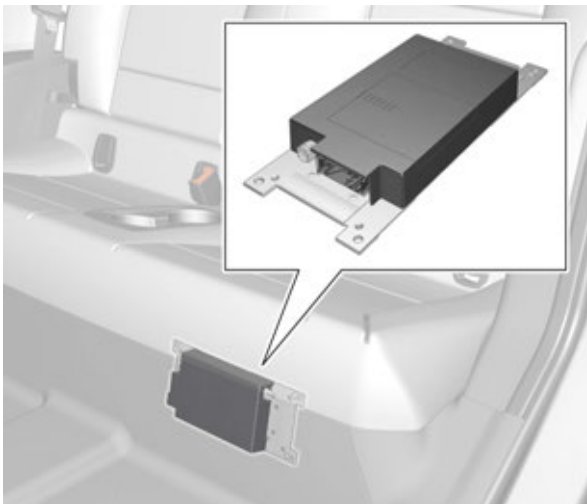


Headunit High

The Headunit High does not have a DVD drive.

The headunit is connected at the K-CAN4 and at the Body Domain Controller via Ethernet.

### 1.6.12. Telematic Communication Box (TCB)



Telematic Communication Box

The Telematic Communication Box (TCB) is connected to the Headunit HIGH and is responsible for the following functions:

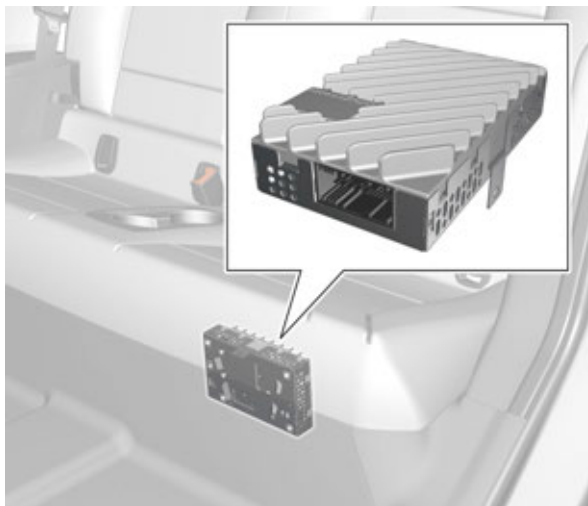
# I01 General Vehicle Electronics

## 1. Vehicle Electrical System

- BMW Assist with eCall (emergency-call function)
- BMW Online
- BMW Internet using a SIM card integrated in the vehicle (P-SIM)
- Remote functions (reception and controller)
- "Text-to-speech" function in Office area
- BMW TeleServices via P-SIM.

The TCB is connected at the K-CAN4 and via USB at the headunit.

### 1.6.13. Audio amplifier (AMP)



Audio amplifier

The audio amplifier AMP receives the audio analog signals from the headunit and amplifies these for the speaker.

The audio amplifier is connected at the K-CAN4.

# I01 General Vehicle Electronics

## 1. Vehicle Electrical System

### 1.6.14. Instrument cluster (KOMBI)



Instrument cluster

The displays of the instrument cluster are shown by a thin-film transistor display. The indicator and warning lights are designed in LED technology.

The instrument cluster is connected at the powertrain CAN.

### 1.6.15. Electrical Digital Motor Electronics (EDME)



Electrical Digital Motor Electronics

The master role for the control of the electric motor in the I01 is assumed by the DME. It is modelled after vehicles with a gasoline engine with "Electrical Digital Motor Electronics" EDME. The EDME has the following functions:

# I01 General Vehicle Electronics

## 1. Vehicle Electrical System

- Evaluation of the driver's choice (accelerator pedal)
- Coordination of torque demands
- Activation of the electrical machine
- Activation of electric fan
- Activation of electric fan in the engine compartment
- Evaluation of the electronic gear selector switch (Shift-by-Wire function)
- Power management for the high-voltage electrical system
- Power management for the low-voltage electrical system
- Activating the electric vacuum pump.

The EDME is connected to the PT-CAN, PT-CAN2 and FlexRay.

### 1.6.16. Charging interface module (LIM)



Charging interface module

The LIM control unit is responsible for the following functions:

- Coordinating the charging procedure
- Activation of the LEDs for displaying the charging status
- Activation of the electric motor for locking the charging socket cover
- Activation of the electric motor for locking the charging plug.

The LIM is connected at the PT-CAN and via a Local-CAN at the charging socket at the vehicle.

# I01 General Vehicle Electronics

## 1. Vehicle Electrical System

### 1.6.17. Gear selector switch (GWS)

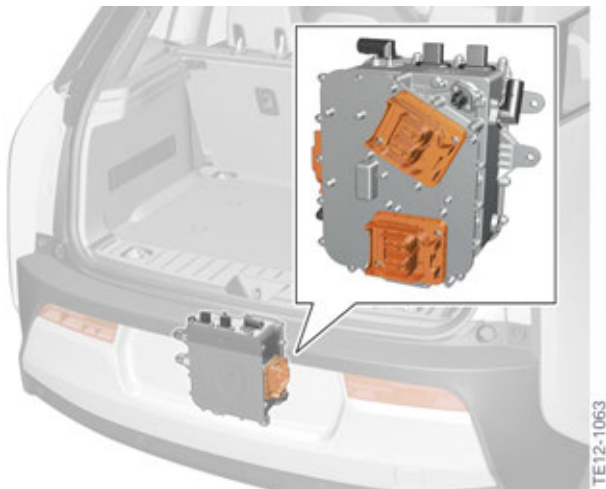


Gear selector switch

The gear selector switch GWS is used for selecting a drive position. It is positioned in the vehicle at the steering column. The parking lock is activated/deactivated using the P button. The drive position is displayed by means of LED. The START-STOP button is also positioned at the gear selector switch.

The GWS is connected at the PT-CAN and PT-CAN2.

### 1.6.18. Convenience charging electronics (KLE)



Convenience charging electronics

**The convenience charging electronics (KLE) is standard equipment for the US market and enables the charging of the high-voltage battery with AC voltage.**

Charging power with AC voltage:

- 3.7 kW power EME and
- 3.7 kW power KLE.

This gives a maximum charging power of 7.4 kW.



# I01 General Vehicle Electronics

## 1. Vehicle Electrical System

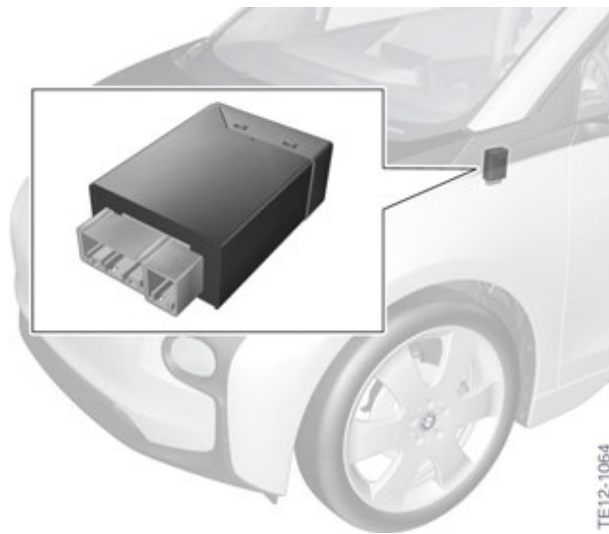
The KLE enables charging with direct current voltage and a power rating of up to maximum 50 kW.

The charging power is dependent on the power of the charging station.

**Note: The charging variants and power are country-dependent. The US market includes the KLE (7.4KW) option as standard in all I01 vehicles.**

The KLE is connected at the PT-CAN2.

### 1.6.19. Hybrid pressure refueling electronic control unit (TFE)



Hybrid pressure refueling electronic control unit

The control unit for the hybrid pressure refueling electronic control unit TFE is only installed in vehicles with range extender.

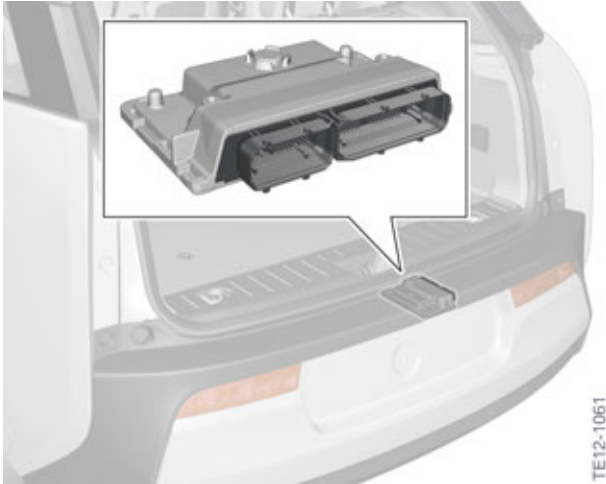
The TFE is required to depressurize the fuel tank before filling. The excess pressure available in the tank is discharged via the carbon canister and the fuel filler flap can then be opened. The activation of the fuel filler flap is done by the hybrid pressure refueling electronic control unit.

The hybrid pressure refueling electronic control unit is connected at the powertrain CAN.

# I01 General Vehicle Electronics

## 1. Vehicle Electrical System

### 1.6.20. Range Extender Digital Engine Electronics (RDME)



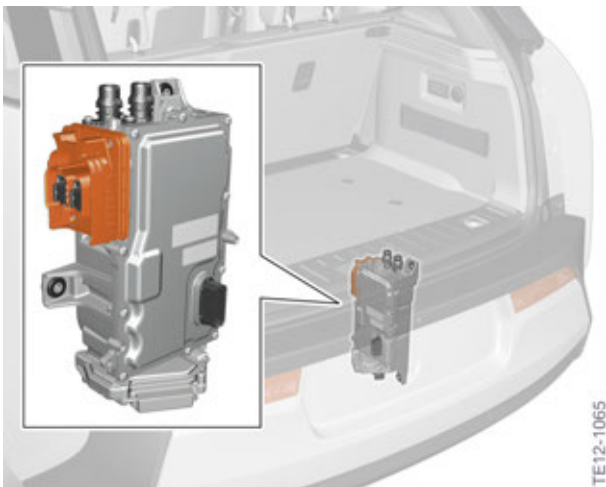
Range Extender Digital Engine Electronics

The control unit RDME is installed in a vehicle with range extender.

The RDME is the DME for the range extender.

The RDME is connected to the PT-CAN and PT-CAN2.

### 1.6.21. Range Extender Electrical Machine Electronics (REME)



Range Extender Electrical Machine Electronics

The range extender electrical machine electronics REME is only installed in vehicles with range extender.

The REME controls the range extender electrical machine. The range extender electrical machine is used to start the range extender. If the combustion engine is running voltage is generated by the range extender electrical machine and the high-voltage battery is charged via the REME.

The REME is connected at the PT-CAN2.

# I01 General Vehicle Electronics

## 1. Vehicle Electrical System

### 1.6.22. Camera-based driver support systems (KAFAS)



Camera-based driver support systems

The control unit camera-based driver support systems KAFAS is required for the following optional equipment:

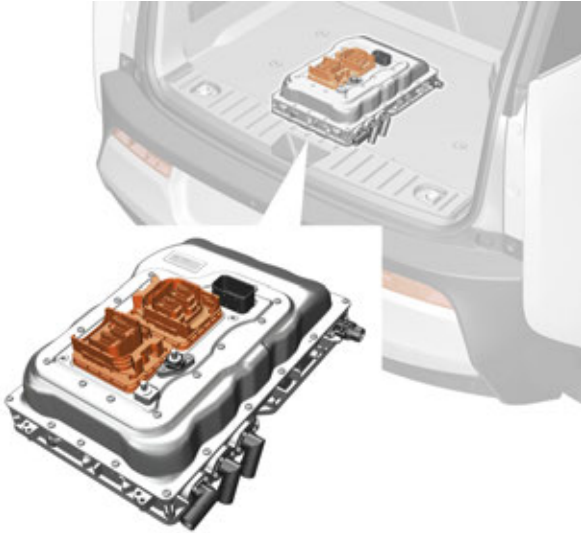
- Camera-based cruise control with Stop&Go function
- Traffic jam assistant
- Road sign recognition
- Collision warning
- Person recognition with city braking function
- Collision warning with city braking function.

The camera-based driver support systems control unit is connected to the PT-CAN and to the optional equipment system via a Local Controller Area Network.

# I01 General Vehicle Electronics

## 1. Vehicle Electrical System

### 1.6.23. Electrical machine electronics (EME)



Electrical machine electronics

The function of the electrical machine electronics is to activate and control the permanently excited electrical machine in the high-voltage electrical system. This necessitates the use of a bidirectional inverter which converts the high direct current voltage of the high-voltage battery into a three-phase alternating current for the electrical machine. The high-voltage battery is charged again by the alternator operation of the electrical machine.

The EME also incorporates the DC/DC converter which is responsible for the voltage supply to the 12 V vehicle electrical system.

The power electronics for charging with AC voltage at 3.7 kW is also located in the EME.

The EME is connected to the PT-CAN and PT-CAN2.

# I01 General Vehicle Electronics

## 1. Vehicle Electrical System

### 1.6.24. Battery management electronics (SME)



Battery management electronics

The SME is integrated in the high-voltage battery and executes among others the following functions:

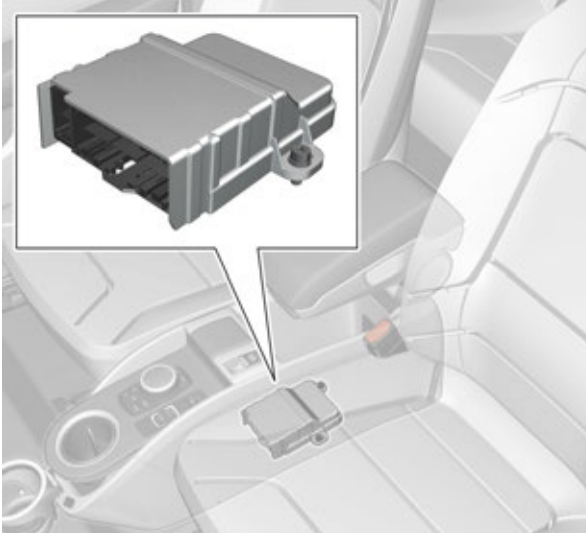
- Monitoring of the state of the lithium-ion battery
- Monitoring of the high-voltage electrical system for insulation faults
- Control of the switch contactors for activating the high-voltage system.

The SME is connected at the PT-CAN2.

# I01 General Vehicle Electronics

## 1. Vehicle Electrical System

### 1.6.25. Advanced Crash Safety Module (ACSM)



Crash Safety Module

The function of the Crash Safety Module ACSM is to permanently evaluate all sensor signals in order to identify a crash situation. The ACSM evaluates the information from the sensors and then forwards corresponding measures for selective activation of the necessary restraint systems.

The ACSM records the yaw rate and sends this information on the FlexRay data bus.

No additional yaw sensors are required for the following systems.

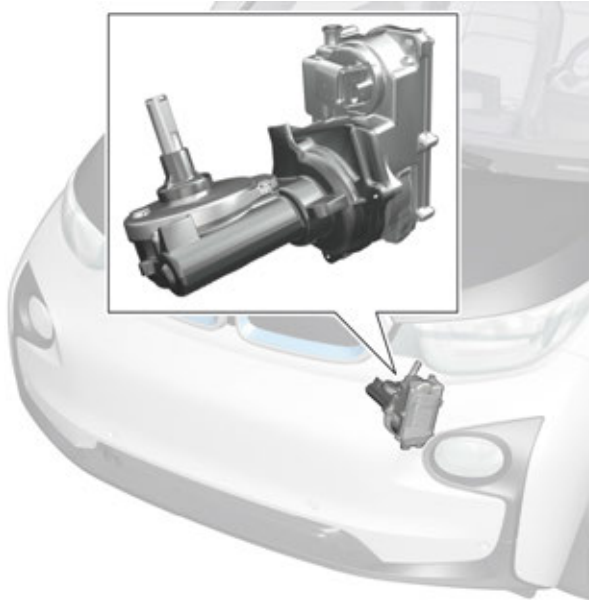
- Dynamic Stability Control
- Navigation system.

The ACSM is connected to the FlexRay.

# I01 General Vehicle Electronics

## 1. Vehicle Electrical System

### 1.6.26. Electronic Power Steering (EPS)



Electronic Power Steering

The Electronic Power Steering supplied with voltage by the 12 V vehicle electrical system.

The steering angle information in the I01 is calculated by the EPS and made available to the other control units via the FlexRay data bus.

The EPS is connected at the FlexRay.

### 1.6.27. Dynamic Stability Control (DSC)



Dynamic Stability Control

# I01 General Vehicle Electronics

## 1. Vehicle Electrical System

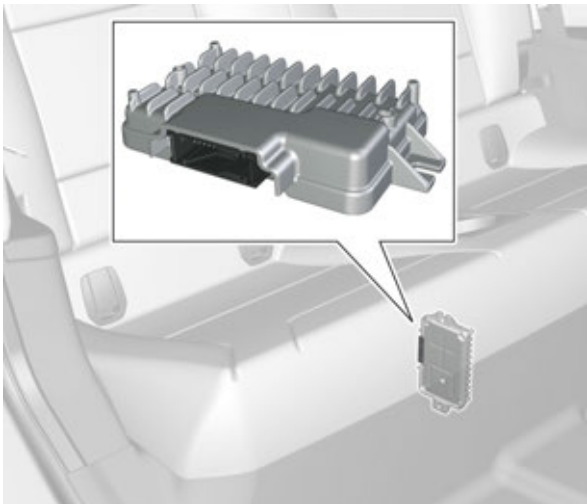
The control unit Dynamic Stability Control (DSC) has new functions and adaptations for an electric vehicle.

New functions:

- Motor tow-away control for electric motor
- Function and stabilization during energy recovery.
- The tire pressure monitoring function (TPMS) is now integrated into the DSC control unit. No separate TPMS control unit is not required, please refer to the “I01 Chassis and Suspension” training manual for more information.

The DSC is connected at the FlexRay.

### 1.6.28. Optional equipment system (SAS)



Optional equipment system

The optional equipment system control unit provides a variety of driver assistance functions.

Possible functions:

- Collision warning with city braking function
- Cruise control with braking function
- Person recognition with city braking function
- Parking Maneuvering Assistant
- Camera-based cruise control with Stop&Go function
- Proactive driving assistant.

The image information required by the optional equipment system is provided by the camera-based driver support systems.



# I01 General Vehicle Electronics

## 1. Vehicle Electrical System

The optional equipment system is not an element of the standard equipment. It is only installed if the customer orders a corresponding optional equipment. In the I01 there is no Integrated Chassis Management ICM. The data required for the driver assistance functions is made available via the FlexRay.

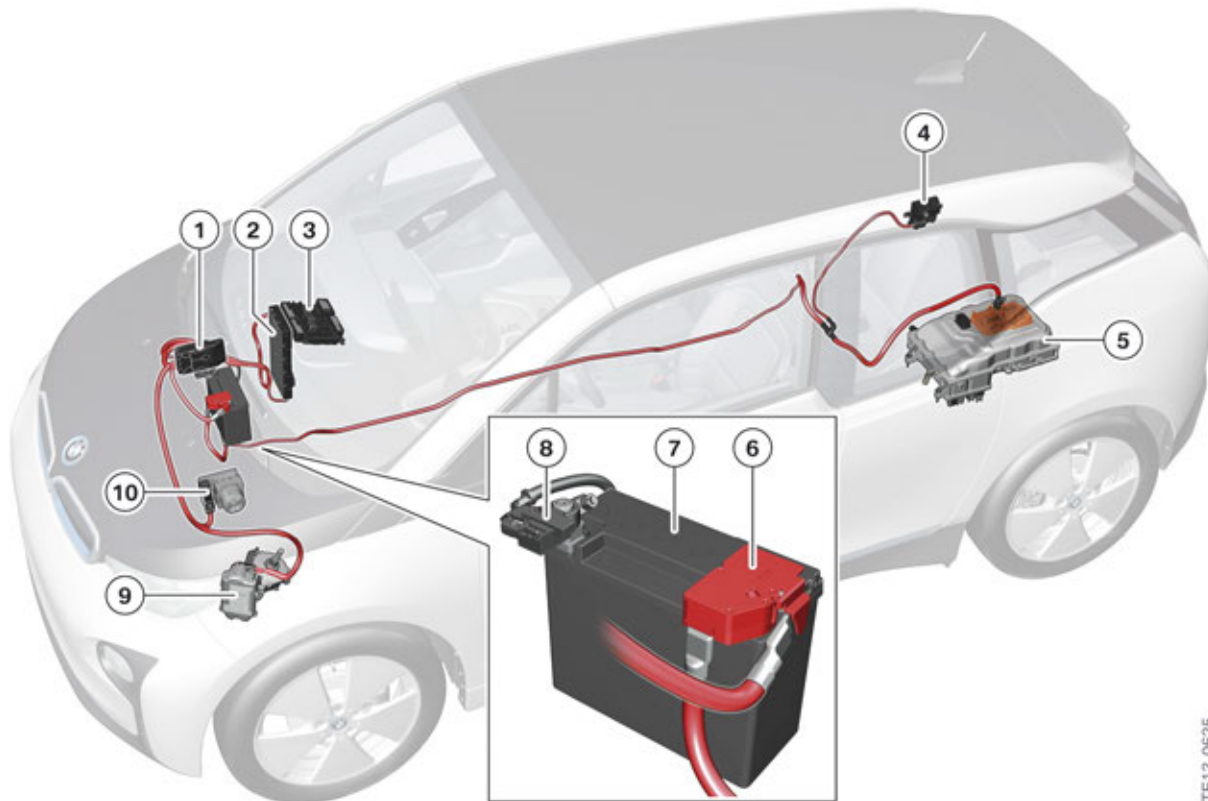
Not all possible functions are offered in all national-market versions.

The optional equipment system is connected at the FlexRay and to a Local Controller Area Network with the camera-based driver support systems KAFAS.

# I01 General Vehicle Electronics

## 2. Voltage Supply

### 2.1. Overview of the 12 V voltage supply



TE13-0625

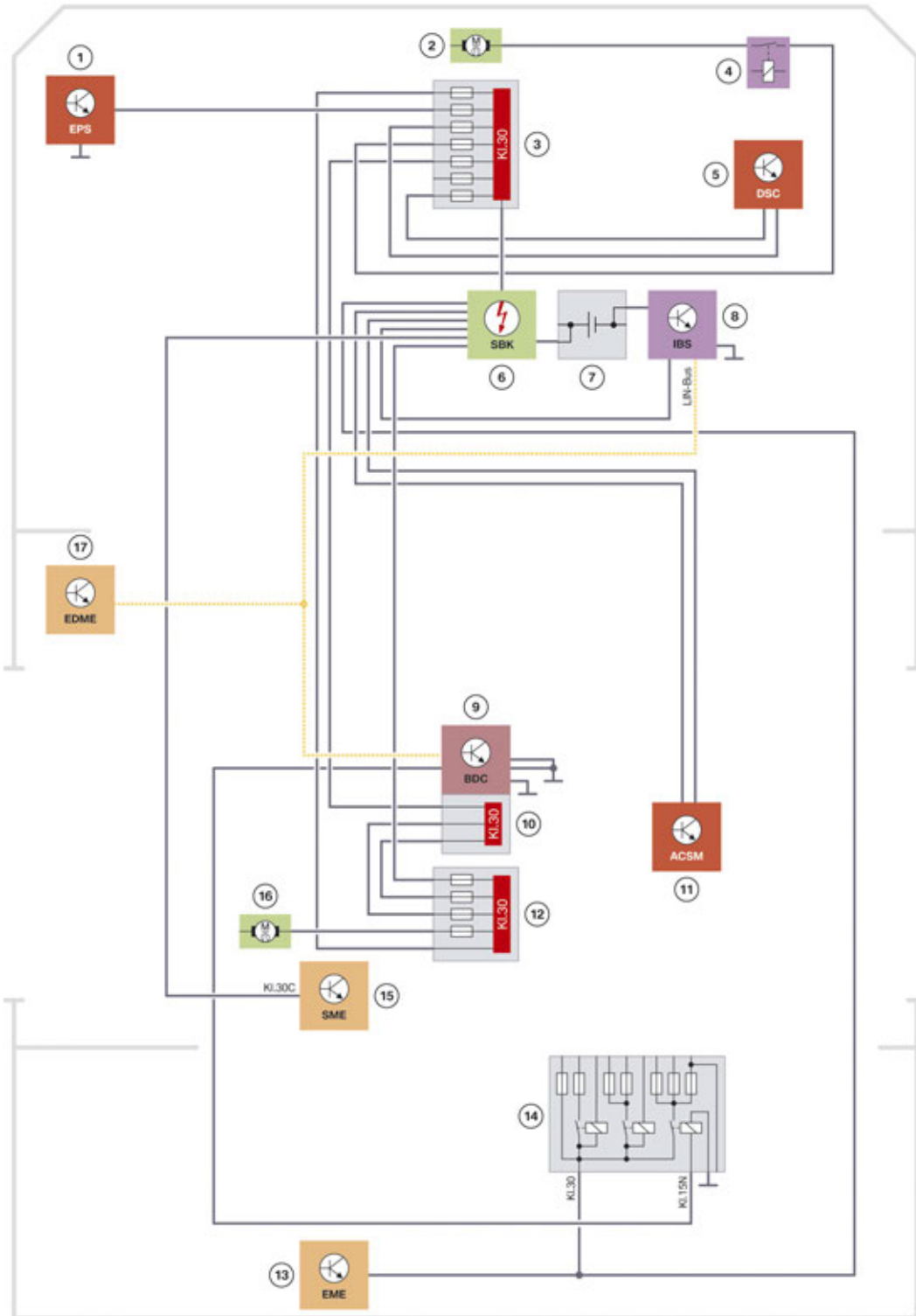
Overview of the 12 V voltage supply

Index	Explanation
1	Power distribution box, front
2	Body Domain Controller
3	Power distribution box, passenger compartment
4	Integrated supply module (only for vehicles with range extender)
5	Electrical machine electronics
6	Safety battery terminal
7	Battery (12 V; 20 Ah; AGM)
8	Intelligent battery sensor
9	Electronic Power Steering
10	Dynamic Stability Control

# I01 General Vehicle Electronics

## 2. Voltage Supply

### 2.2. System wiring diagram



I01 system wiring diagram for voltage supply

TE12-1091

# I01 General Vehicle Electronics

## 2. Voltage Supply

Index	Explanation
1	Electronic Power Steering
2	Electric fan
3	Fuses in the power distribution box at the front
4	Relay for electric fan
5	Dynamic Stability Control
6	Safety battery terminal
7	12 V battery
8	Intelligent battery sensor
9	Body Domain Controller
10	Fuses in the Body Domain Controller
11	Crash Safety Module
12	Fuses in the power distribution box in the passenger compartment
13	Electrical machine electronics
14	Integrated supply module (only for vehicles with range extender)
15	Battery management electronics
16	Blower motor
17	Electrical Digital Motor Electronics

### 2.3. Components

The voltage supply of the I01 comprises the following components:

- 12 V battery
- Intelligent battery sensor (IBS)
- Safety battery terminal (SBK)
- Integrated supply module (only for vehicles with range extender)
- Power distribution box, front
- Power distribution box, passenger compartment
- DC/DC converter in the electrical machine electronics for supplying the 12 V vehicle electrical system with power
- Ground connections.

#### 2.3.1. Battery

For the voltage supply of the 12 V vehicle electrical system a 20 Ah AGM battery is used.

# I01 General Vehicle Electronics

## 2. Voltage Supply

In contrast to a vehicle with a combustion engine, the requirements of the 12 V battery in the I01 with regard to an engine start are different. In the I01 the job of the 12 V battery is only to ensure the powering up of the high-voltage system. What is required of the 12 V battery is no longer a minimum SoC to ensure engine starting, but rather a minimum SoC to protect the 12 V battery against freezing at temperatures below 0 °C and to power up the high-voltage system.

The voltage supply of the 12 V vehicle electrical system (and also the charging of the 12 V battery) is not provided by the conventional alternator, but via the DC/DC converter in the EME.

### 2.3.2. Intelligent battery sensor (IBS)

The IBS records the following data of the 12 V battery:

- Voltage
- Current
- Pole temperature.

The IBS performs the calculation and the evaluation of the information. The results are then forwarded to the superior control units via local interconnect network bus (EDME and BDC).

### 2.3.3. Safety battery terminal (SBK)

The safety battery terminal (SBK) is activated in the event of an accident of corresponding severity.

The following lines are separated:

- Battery positive wire for the electrical machine electronics (EME)
- Battery positive wire for the integrated supply module (in vehicles with range extender)
- Terminal 30C for battery management electronics (SME).

#### Terminal 30C (crash message)

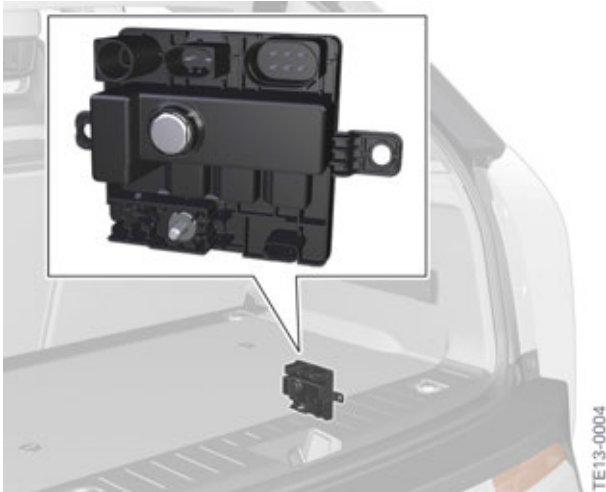
In the event of a missing signal from terminal 30C, the SME performs a quick shut-down of the high-voltage system.

The line from the safety battery terminal to the battery management electronics is shown in the wiring diagram. The high-voltage safety connector is located in this line. In a vehicle with the optional equipment convenience charging electronics there is another junction for the convenience charging electronics (KLE).

# I01 General Vehicle Electronics

## 2. Voltage Supply

### 2.3.4. Integrated supply module

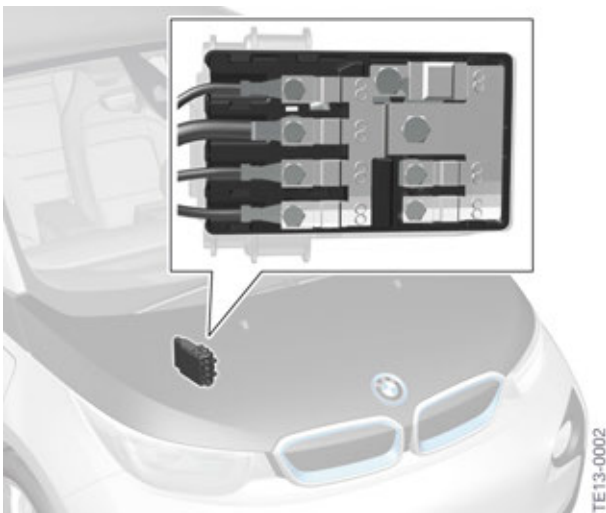


Integrated supply module

The integrated supply module is only installed in vehicles with range extender.

The integrated supply module supplies the range extender digital engine electronics and the 12 V components of the range extender with voltage.

### 2.3.5. Power distribution box, front



Power distribution box, front

The power distribution box at the front is powered by the 12 V battery.

The following components are supplied with voltage via the power distribution box at the front and protected accordingly:

# I01 General Vehicle Electronics

## 2. Voltage Supply

- Power distribution box, passenger compartment
- Electronic Power Steering
- Dynamic Stability Control (valves)
- Dynamic Stability Control (pump)
- Electric fan
- Body Domain Controller.

### 2.3.6. Body Domain Controller (BDC)



Body Domain Controller

The Body Domain Controller (BDC) is responsible for the terminal control:.

In the I01 there are 2 relays for terminal 30F and 2 relays for terminal 30B.

There is a relay for terminal 30F in the BDC.

The following relays in the power distribution box in the passenger compartment are activated by the BDC:

- Terminal 30F
- Terminal 30B
- Terminal 15N.

The voltage supply and protection of the following components is done by the BDC.

#### Components at terminal 30

- Power distribution box, passenger compartment

# I01 General Vehicle Electronics

## 2. Voltage Supply

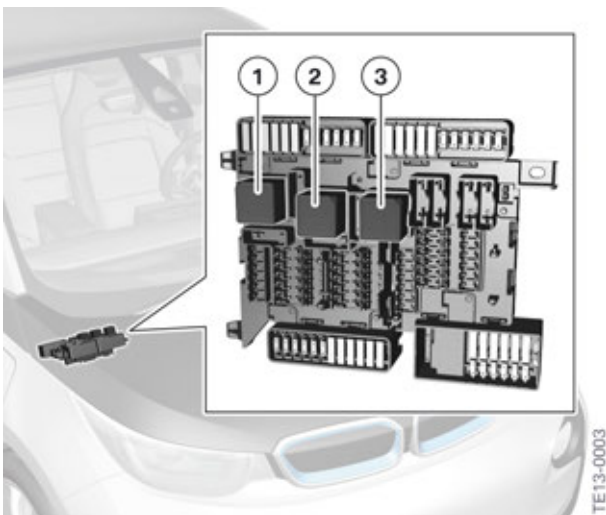
### Components at terminal 30F

- Steering column switch cluster (SZL)
- Driver assistance system operating facility
- Operating unit for light
- OBD2 connection
- Automatic Integrated heating / air-conditioning (IHKA)
- Outside door handle electronics.

The following components are switched by a relay in the BDC and are protected accordingly:

- Power window regulators
- Central locking system
- Horn
- Heated rear window.

### 2.3.7. Power distribution box, passenger compartment



Power distribution box, passenger compartment

Index	Explanation
1	Relay, terminal 30B
2	Relay, terminal 30B
3	Relay, terminal 15N

The following relays are located in the power distribution box in the passenger compartment:



# I01 General Vehicle Electronics

## 2. Voltage Supply

- 2 x terminal 30B
- Terminal 15N
- Terminal 30F (soldered in the power distribution box).

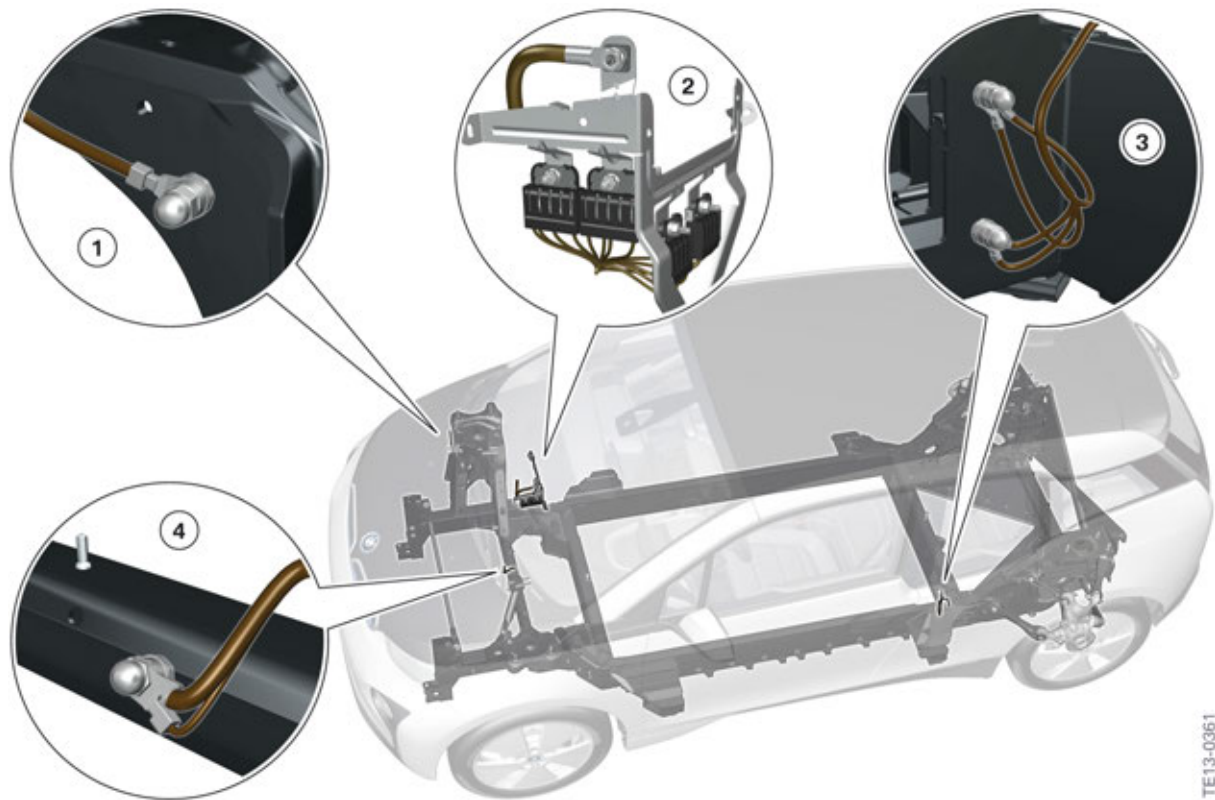
There is another relay for terminal 30F in the Body Domain Controller.

All relays are activated by the BDC.

### 2.3.8. DC/DC converter in the EME

The DC/DC converter for the voltage supply and the charging of the 12 V battery is located in the EME.

### 2.3.9. Ground connections



Ground connections

TE13-0361

Index	Explanation
1	Ground Drive module at the right spring strut
2	Ground Life module in the area of the power distribution box in the passenger compartment
3	Ground Drive module at the rear cross member
4	Ground Drive module at the front cross member

# I01 General Vehicle Electronics

## 2. Voltage Supply

Other ground connections can also be located at the Drive module corresponding to the vehicle equipment and national-market version.

In the I01 the ground connections for the consumers cannot be connected to the body because of the use of carbon for the Life module. The grounding cables of all consumers are connected to ground support points.

The ground support points are located:

- Directly at the ground for the Drive module
- In the case of the Life module via a ground cable at a ground distribution block, which in turn is connected to the Drive module.

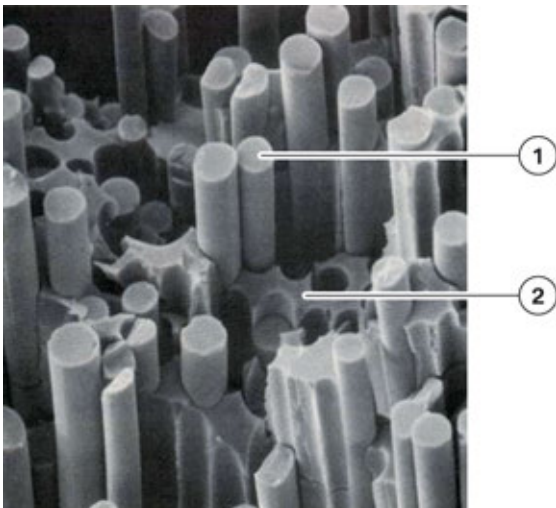
### Electrical characteristics of carbon

Carbon is used for the industrial manufacturing of carbon fibers. If these carbon fibers are also introduced to a resin, carbon fiber-reinforced plastic, which is also referred to as CFRP, is obtained. For the sake of simplicity, this product is referred to as "carbon" in this document.

A differentiation is made between short fibers (0.1 – 1 mm long), long fibers (1 – 50 mm long) and endless fibers (> 50 mm long). The fibers are used for different processing technologies, according to their length.

The short and long fibers are suitable for fiber spraying. During this process, the fibers are sprayed with a resin in a form. Endless fibers are processed further to obtain rovings (bundles), or other semi-finished textile products such as woven fabrics.

The resin fixes the carbon fibers in the required arrangement and transmits the applied forces to and between the fibers. The material carbon ultimately only exists once the carbon fibers are introduced into the resin.



Structure of carbon

TK12-0686

# I01 General Vehicle Electronics

## 2. Voltage Supply

---

Index	Explanation
1	Carbon fiber
2	Resin

---

The electrical and thermal conductivity of the carbon fibers themselves is extremely good. However, as soon as they are introduced into the resin, the resin defines the conductivity properties. The electrical and thermal conductivity is then extremely low as the carbon fibers are encased in resin. The carbon fibers are not covered entirely in resin, but can also be exposed at the component surface.

The passenger compartment made from carbon is connected to the aluminium frame. The aluminium frame is connected to ground. As the carbon fibers establish contact with this aluminium frame, the passenger compartment has an undefined potential similar to ground.



---

If the insulation of a live electrical line becomes damaged as a result of an incident, such as:

- Accident
- Crushed cable
- Improper repair

and if the electrical conductor touches the carbon passenger compartment, a current may flow through the carbon fiber depending on the circumstances.

---

With a vehicle voltage of 12 V the current level is in the range of a few amperes. This means a fuse installed for the protection of the electrical line would not activate under certain circumstances.

The current flow through the carbon fibers would also cause a thermal event at the contact points for the carbon fibers. Due to the good thermal conductivity this thermal event would also spread to other parts/components in the event of continued current flow. The resulting gases are harmful and have an unpleasant odor.



---

Exercise extreme caution when working on electrical lines.

Lines or connectors which are not insulated cannot touch the carbon body components.

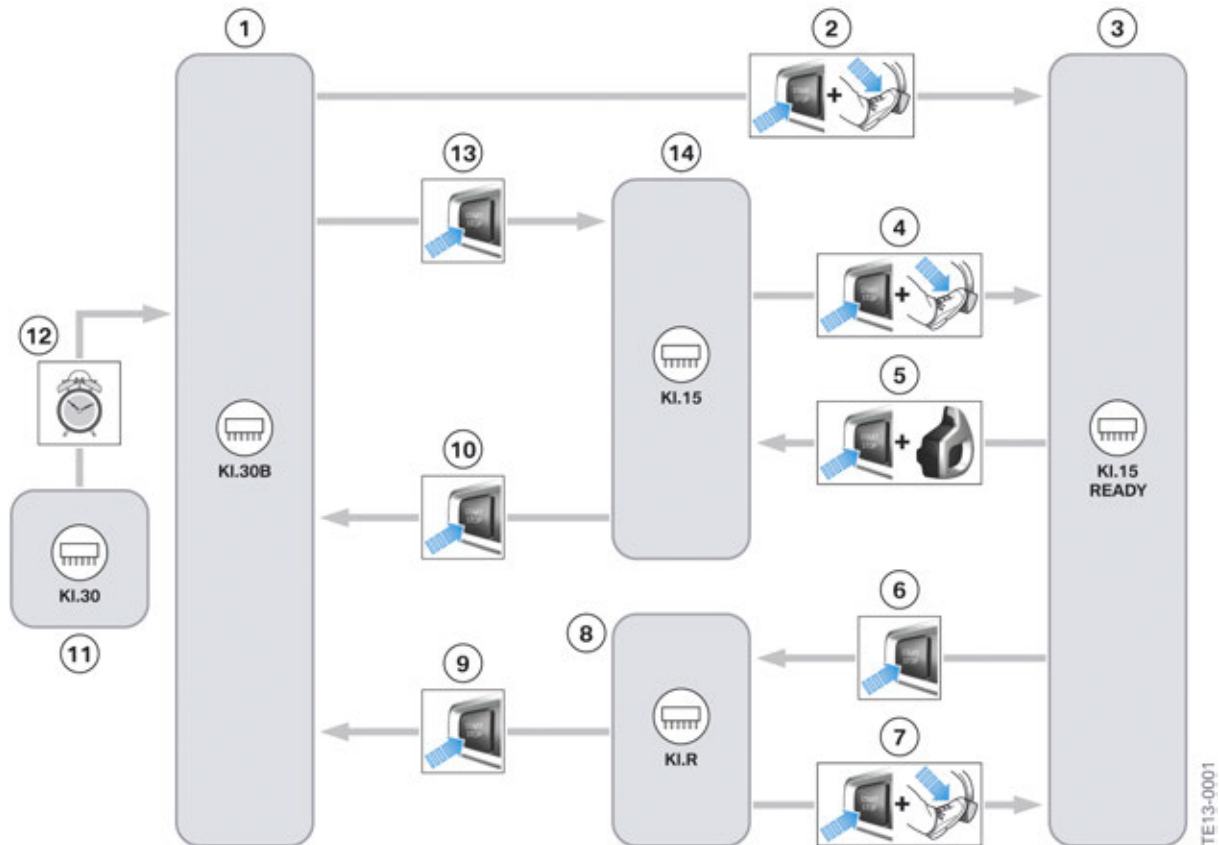
In each case follow the general and special information on electrical characteristics of the carbon body in the repair instructions!

---

# I01 General Vehicle Electronics

## 2. Voltage Supply

### 2.4. Terminal control



I01 Terminal control

Index	Explanation
1	Terminal 30B
2	The driving readiness is activated by simultaneously pressing the START-STOP button and the brake pedal
3	"Ready to drive" with terminal 15
4	The driving readiness is activated by simultaneously pressing the START-STOP button and the brake pedal
5	By pressing the START-STOP button when the N gear is engaged the terminal status switches to car wash mode
6	When the START-STOP button is pressed the terminal status changes from terminal 15 to terminal R
7	The driving readiness is activated by simultaneously pressing the START-STOP button and the brake pedal
8	Terminal R
9	When the START-STOP button is pressed the terminal status changes from terminal R to terminal 30B.

# I01 General Vehicle Electronics

## 2. Voltage Supply

Index	Explanation
10	When the START-STOP button is pressed the terminal status changes from terminal 15 to terminal 30B.
11	Terminal 30
12	Vehicle is woken up by a wake-up event
13	By pressing the START-STOP button the terminal status switches from terminal 30B to terminal 15. If the START-STOP button is pressed again within 10 seconds, the following Check Control message "Press brake for engine start" is displayed
14	Terminal 15

Terminal 15 is switched off if the vehicle has been locked or the state of charge of the battery is too low.

The driving readiness is deactivated by pressing the START-STOP button when the vehicle is stationary. The drive position "P" is automatically engaged in the process. The car wash function is an exception to this: If the driver engages the drive position "N" when the driving readiness is switched on and then presses the START-STOP button, the drive position "N" remains engaged and terminal 15 remains switched on.

### 2.5. Energy management

Functions such as the seat heating or heated rear window require lots of energy and reduce the range of the vehicle.

The driving programs ECO PRO and ECO PRO+ support the energy-saving consumption of convenience functions. They automatically perform a partial or complete deactivation of these functions.

#### ECO PRO

- Reduction of the heater output or the switched-on period of the exterior mirror, rear window and seat heating.
- Reduction of the cooling power or heater output of the heating and air-conditioning system.
- Restriction of the speed to an adjustable maximum value between 90 and 130 km/h. The speed limit can be deliberately exceeded by pressing the accelerator.

#### ECO PRO+

The following settings are also performed upon activation of ECO PRO +:

- Deactivation of the cooling power and heater output of the heating and air-conditioning system. Restricted to de-misting windshield.
- Deactivation of the seat heating.
- Restriction of the speed to a maximum value of 90 km/h. The speed limit can be deliberately exceeded by pressing the accelerator pedal.

# I01 General Vehicle Electronics

## 2. Voltage Supply

### 2.6. Emergency charging

It is not possible to operate the vehicle if the high-voltage battery and 12 V battery are not charged.

In order to put the vehicle back into operation, the charging cable for charging the high-voltage battery must be connected. If necessary manually unlock the charging socket cover and connect the charging cable. Emergency charging is started automatically. The charging status is not displayed.

The 12 V battery is charged somewhat after a few minutes. The 12 V vehicle electrical system is ready for operation again. The high-voltage system can be started, the high-voltage battery can therefore be charged. The charging status of the high-voltage battery can be displayed again. Continue to charge the vehicle until the state of charge for the desired range is reached.

An additional AC/DC converter is located in the electrical machine electronics (EME) for the emergency charging function. This supplies the electronics of the EME if the 12 V battery is discharged, thus enabling the start-up of the high-voltage system. With an active high-voltage system the 12 V battery is charged using the DC/DC converter in the EME by the high-voltage battery.

### 2.7. Diagnosis and programming

So that the high-voltage and the 12 V battery are not discharged during diagnosis and programming, these have to be charged accordingly. The procedure for charging is different during diagnosis and programming.

#### 2.7.1. Diagnosis

For diagnosis work at the vehicle the high-voltage battery can be charged using a charging cable. With terminal 15 switched on the 12 V vehicle electrical system is supplied with power via the DC/DC converter and the 12 V battery charged.

#### 2.7.2. Programming

During programming the 12 V battery must be charged using an external 12 V charger.

It is not possible to charge the high-voltage battery via the 12 V vehicle electrical system. During programming the high-voltage system is switched off if necessary.

# **I01 General Vehicle Electronics**

## **3. Exterior Lights**

The I01 is equipped with LED headlights as standard equipment (for the US market).

LEDs are also installed for the side lights and daytime driving lights.

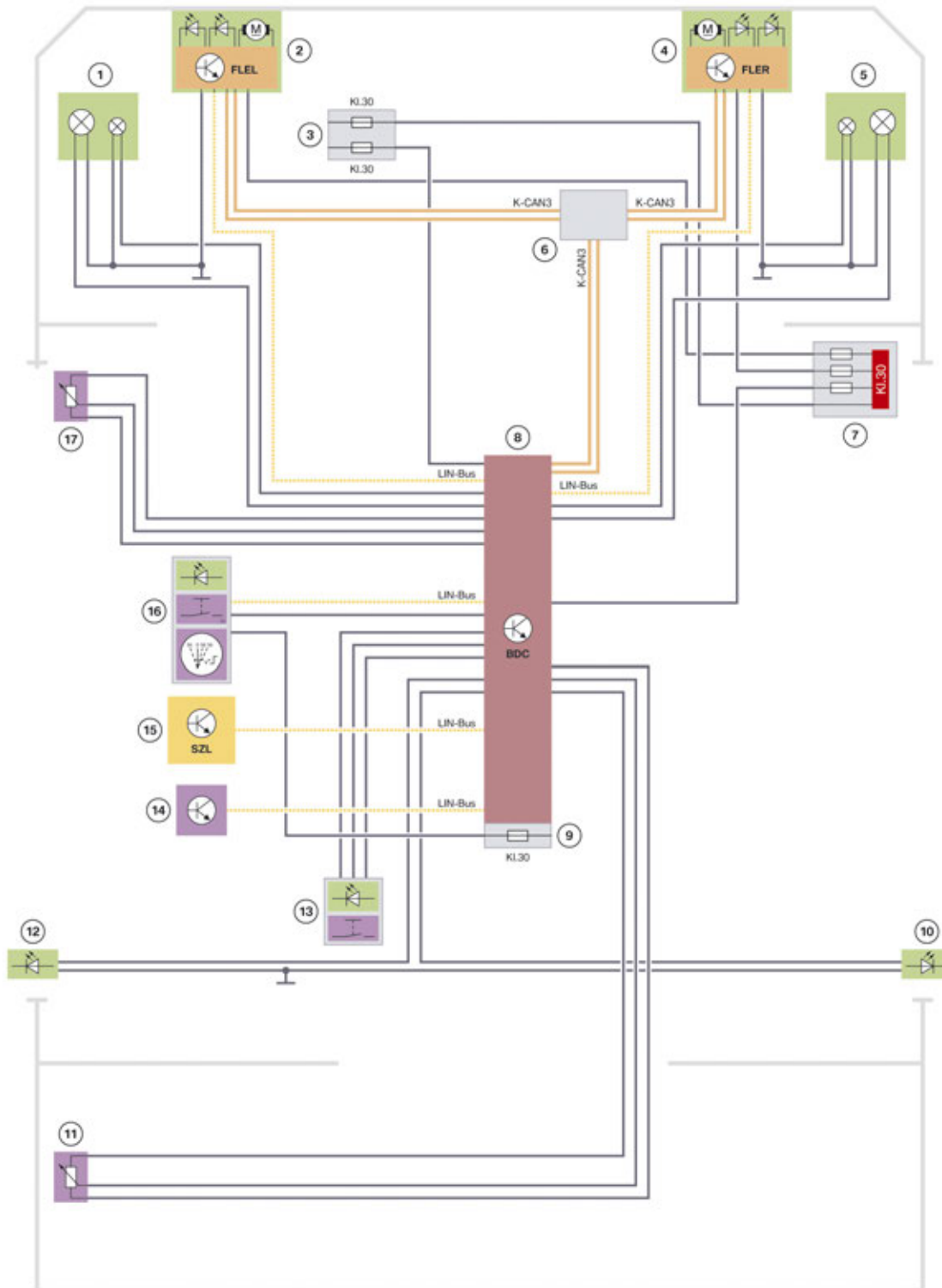
Incandescent bulbs are installed for the front turn indicator.

# I01 General Vehicle Electronics

## 3. Exterior Lights

### 3.1. System wiring diagram

#### 3.1.1. LED headlight



TE13-0047



# I01 General Vehicle Electronics

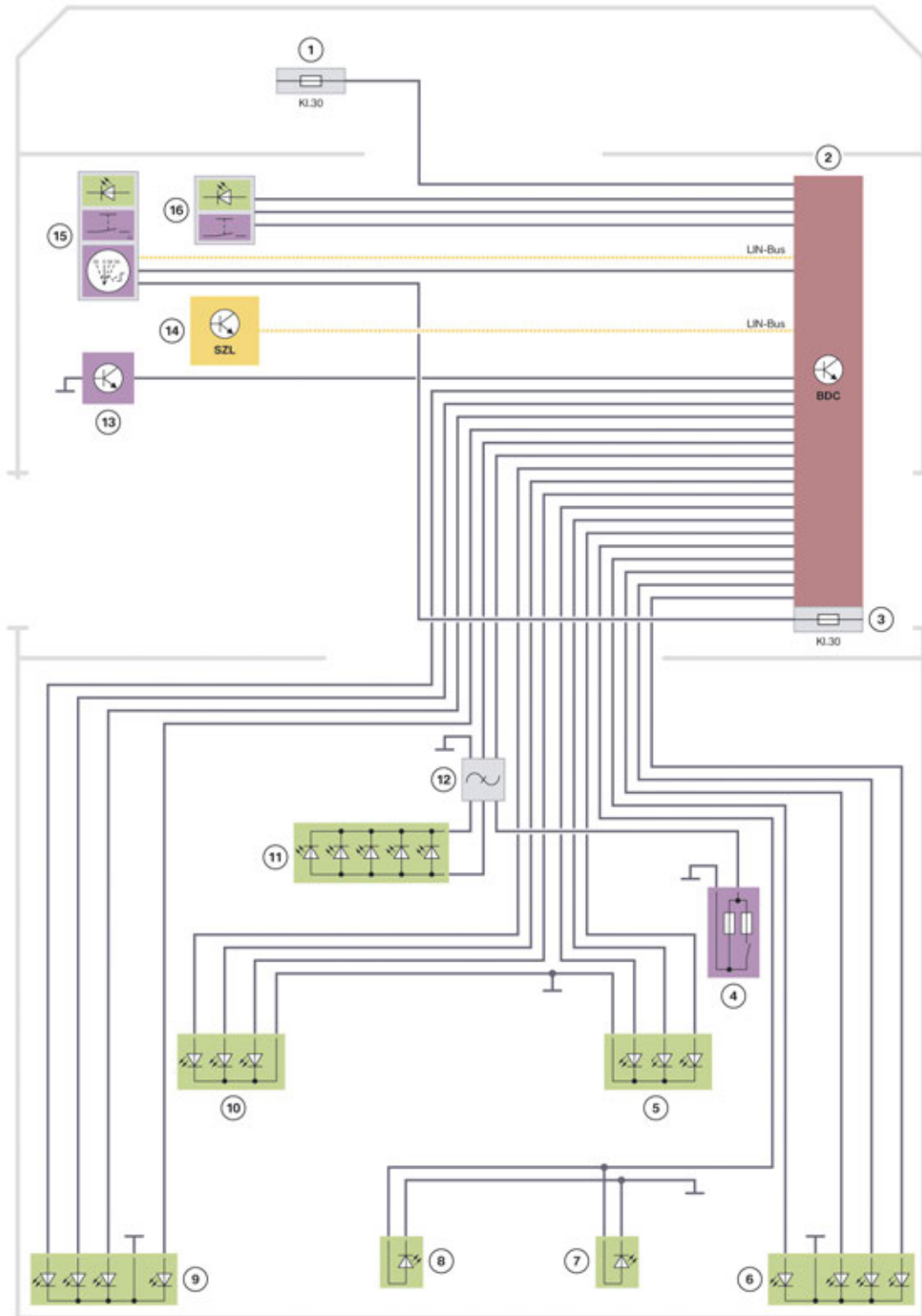
## 3. Exterior Lights

<b>Index</b>	<b>Explanation</b>
1	High-beam headlight with turn indicator, left
2	Headlight, left
3	Fuses in the power distribution box at the front
4	Headlight, right
5	High-beam headlight with turn indicator, right
6	CAN terminator
7	Fuses in the power distribution box in the passenger compartment
8	Body Domain Controller
9	Fuse in the Body Domain Controller
10	Additional turn indicator, exterior mirror, front passenger side
11	Ride height sensor, rear
12	Additional turn indicator, exterior mirror, driver's side
13	Hazard warning switch
14	Rain-light-solar-condensation sensor
15	Steering column switch cluster (SZL)
16	Light switch
17	Ride height sensor, front

# I01 General Vehicle Electronics

## 3. Exterior Lights

### 3.1.2. LED rear lights



TE13-0047

System wiring diagram for rear exterior lights with LED rear lights

# I01 General Vehicle Electronics

## 3. Exterior Lights

Index	Explanation
1	Fuse in the power distribution box at the front
2	Body Domain Controller
3	Fuse in the Body Domain Controller
4	Tailgate contact
5	Rear light, top right
6	Rear light, bottom right
7	Number plate light, right
8	Number plate light, left
9	Rear light, bottom left
10	Rear light, top left
11	Additional brake light
12	Interference suppression filter
13	Brake light switch
14	Steering column switch cluster (SZL)
15	Light switch
16	Hazard warning switch

### 3.2. Lighting, front

#### 3.2.1. LED headlight



LED headlight

Index	Explanation
1	Side lights and daytime driving lights
2	Low-beam headlight

LEDs are used for the low-beam headlight, side lights and daytime driving lights (LEDs in icons).

# I01 General Vehicle Electronics

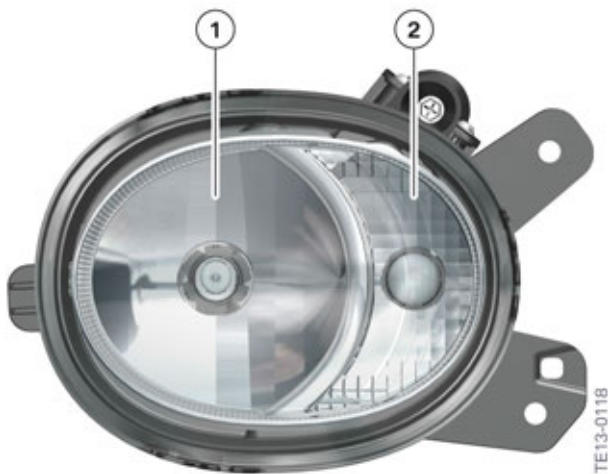
## 3. Exterior Lights

The control units for the LED headlights, the Frontal Light Electronics Left (FLEL) and Frontal Light Electronics Right (FLER), are installed in the left and right headlight.

The Frontal Light Electronics includes:

- The activation of the LEDs in the corresponding headlight
- The activation of the stepper motor for the headlight beam throw adjustment.

### 3.2.2. High-beam headlight and turn indicator



High beam headlight/Turn indicator

Index	Explanation
1	High-beam headlight
2	Turn indicator

Bulbs are used for high-beam headlight and turn indicator.

The bulbs have the following power:

- High-beam headlight 55 W H7
- Turn indicator 21 W.

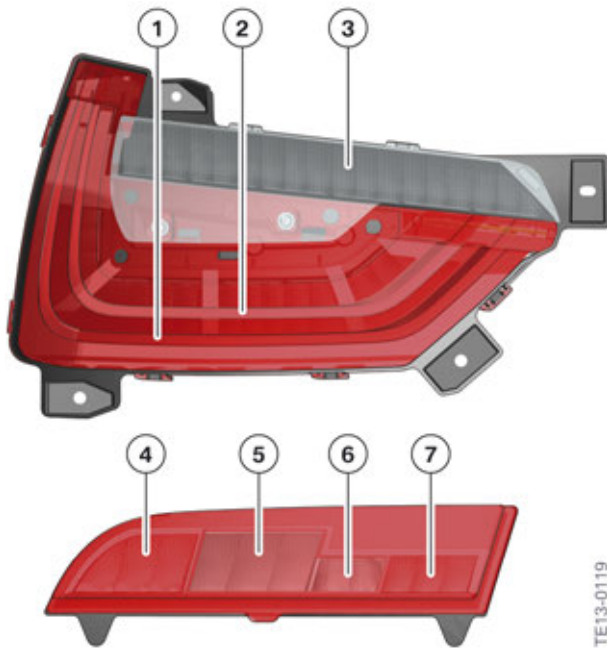
### 3.3. Lighting, rear

The I01 has a two-part rear light, so that the vehicle can also be identified when the tailgate is opened. One part is located in the tailgate, the other in the bumper panel. The following lights in the bumper panel are only active when the tailgate is open:

- Tail light
- Brake light
- Turn indicator.

# I01 General Vehicle Electronics

## 3. Exterior Lights



Lighting, rear

Index	Explanation
1	Tail light
2	Brake light
3	Turn indicator
4	Tail light/Brake light <sup>1</sup>
5	Turn indicator <sup>2</sup>
6	Reverse light
7	Rear fog light

<sup>1</sup>The tail light and brake light in the bumper panel are only active when the tailgate is open. The tail light of the tailgate is switched off when the tailgate is open.

<sup>2</sup>The turn indicator in the bumper panel is active when the tailgate is open.

LEDs are used for all lights for the rear lighting.

# I01 General Vehicle Electronics

## 4. Interior Lighting

Depending on the optional equipment selected the I01 has different light elements for the interior light.

With the interior design packages Mega World (option 7KX), Giga World (option 7KY) and Tera World (option 7KZ) the customer has ambient lighting in the passenger compartment. This includes LED elements at various locations in the passenger compartment. Depending on the selection in the central information display white or orange LEDs are activated for the accent lighting. The brightness of the ambient lighting can also be adjusted via the CID.

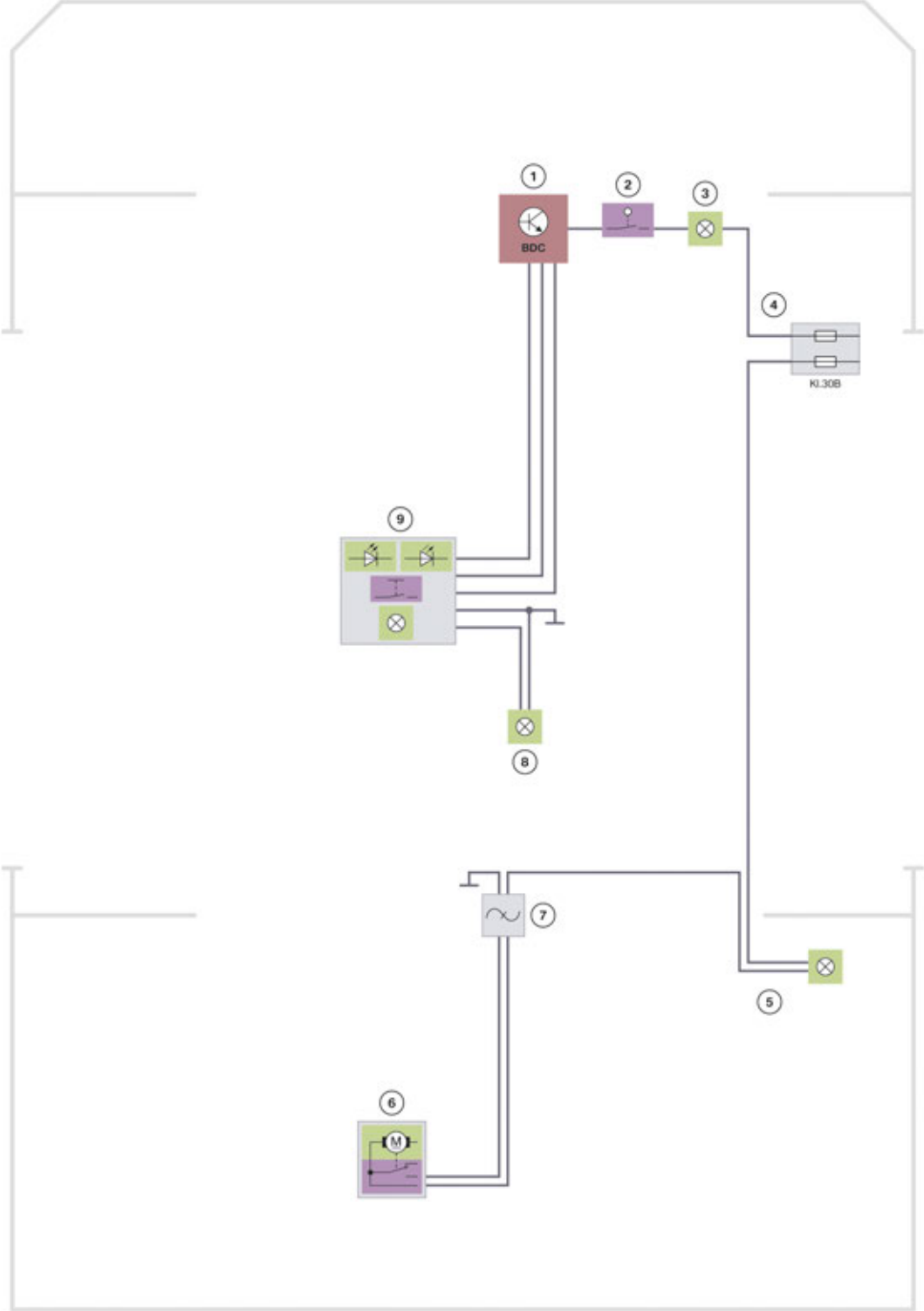
In the I01 the following variants of the interior light are possible:

- without local interconnect network bus connection (standard equipment)
- with local interconnect network bus connection (optional equipment).

# I01 General Vehicle Electronics

## 4. Interior Lighting

### 4.1. System wiring diagram for interior light without local interconnect network bus



System wiring diagram for interior light without local interconnect network bus

# I01 General Vehicle Electronics

## 4. Interior Lighting

Index	Explanation
1	Body Domain Controller (BDC)
2	Glove box switch
3	Glove box light
4	Fuses in the power distribution box in the passenger compartment
5	Luggage compartment light
6	Tailgate contact with tailgate lock
7	Interference suppression filter
8	Rear interior light
9	Front interior light unit

The interior light is controlled by the BDC.

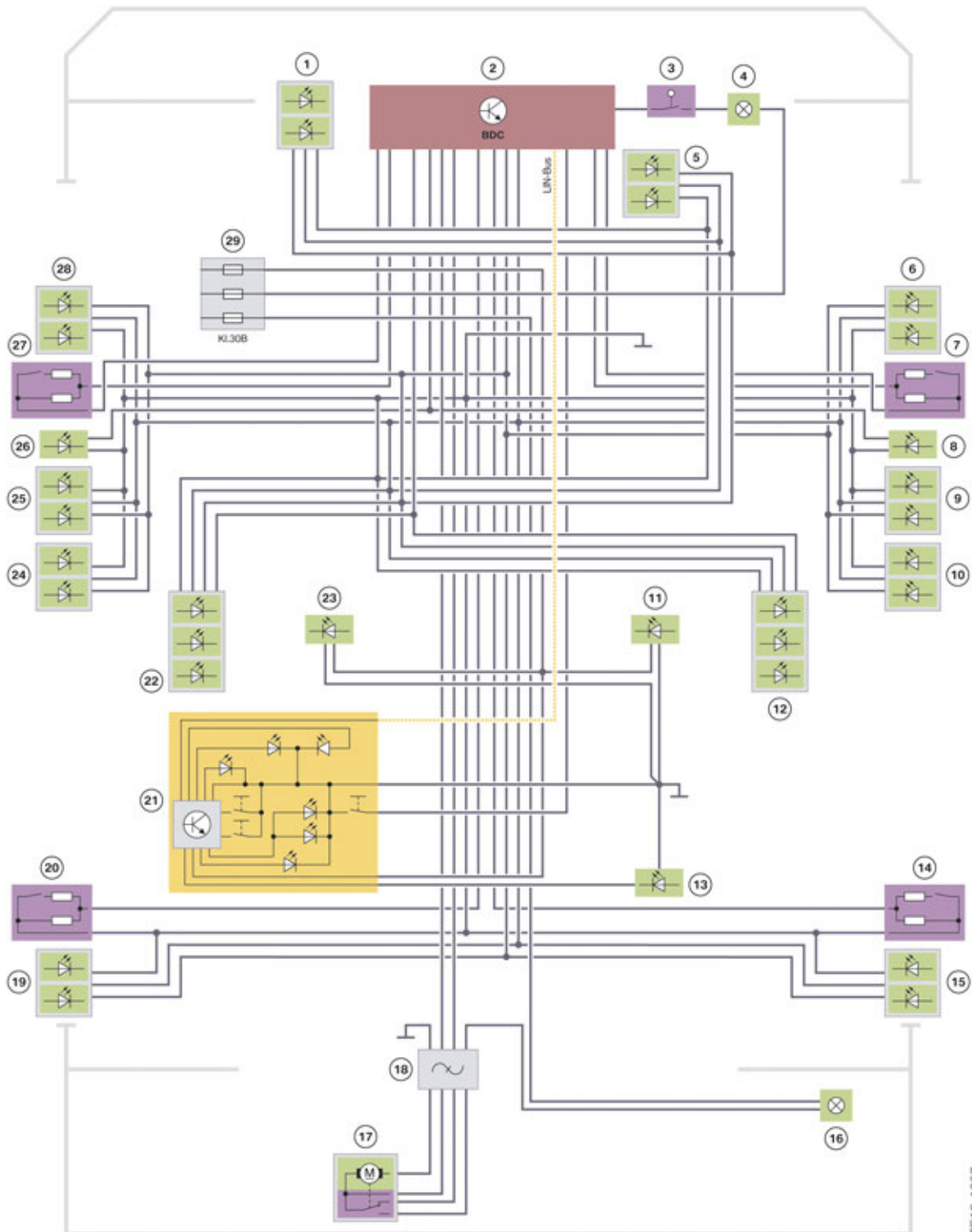
The output stage for the interior lighting is located in the BDC.



# I01 General Vehicle Electronics

## 4. Interior Lighting

### 4.2. System wiring diagram for the interior light with local interconnect network bus



System wiring diagram for the interior light I01 with local interconnect network bus

TE12-1007

# I01 General Vehicle Electronics

## 4. Interior Lighting

Index	Explanation
1	Lighting, cockpit center <sup>1</sup>
2	Body Domain Controller (BDC)
3	Glove box switch
4	Glove box light <sup>1</sup>
5	Lighting, CID area
6	Door pocket lighting, passenger's side <sup>1</sup>
7	Door contact, front passenger's side, front
8	Ground lights for outer door handle on front passenger's side <sup>1</sup>
9	Inside door handle light on front passenger's side <sup>1</sup>
10	Lighting for handle on front passenger's side <sup>2</sup>
11	Vanity mirror light on passenger's side <sup>1</sup>
12	Footwell light, passenger's side <sup>1</sup>
13	Rear interior light
14	Door contact on front passenger's side, rear
15	Lighting for handle on rear passenger's side <sup>2</sup>
16	Luggage compartment light
17	Tailgate contact with tailgate lock
18	Interference suppression filter
19	Lighting for handle on driver's side, rear <sup>2</sup>
20	Door contact on driver's side, rear
21	Interior light unit, front <sup>3</sup>
22	Footwell light, driver's side <sup>1</sup>
23	Vanity mirror light on driver's side <sup>1</sup>
24	Lighting for handle on front driver's side <sup>2</sup>
25	Inside door handle light on front driver's side <sup>1</sup>
26	Ground lights for outer door handle on front driver's side <sup>1</sup>
27	Door contact, driver's side, front
28	Door pocket lighting, driver's side <sup>1</sup>
29	Fuses in the power distribution box in the passenger compartment

<sup>1</sup>Available with interior design Mega World (option 7KX), Giga World (option 7KY) or Tera World (option 7KZ)

# I01 General Vehicle Electronics

## 4. Interior Lighting

<sup>2</sup>Available only with interior design Tera World (option 7KZ)

<sup>3</sup>The number of lights and the type of the design varies depending on the vehicle equipment.

The interior light unit is connected via local interconnect network bus to the Body Domain Controller. The electronics for the interior lights at the front and rear is located in the interior light unit. All other LEDs of the interior light are activated by the BDC.

# I01 General Vehicle Electronics

## 5. Wash/wipe System

The I01 is equipped with two windshield wipers and a rear wiper.

Similar to other BMW models, the following wiper functions are possible:

- Intermittent wipes
- Continuous wipe in interval stage 1
- Continuous wipe in interval stage 2
- Flick wipes.

Available as optional equipment for the I01:

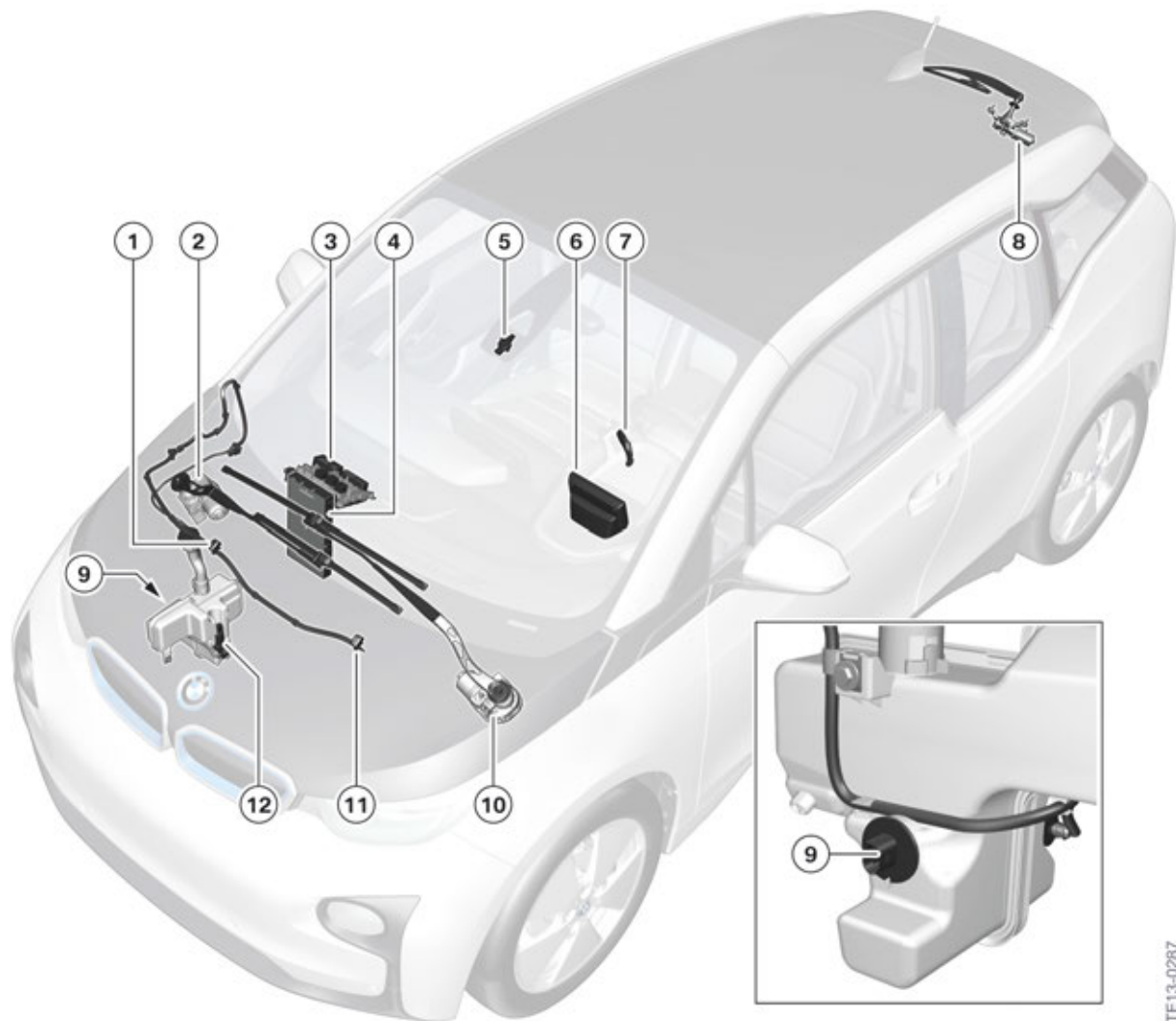
- Wiper nozzle heating (standard)
- Automatic function via rain-light-solar-condensation sensor.

### 5.1. System components

The I01 uses (for the first time) a windshield wiper system which works in the opposite direction. This takes up significantly less space than a wiper system which mechanism operates in the same direction.

# I01 General Vehicle Electronics

## 5. Wash/wipe System



TE13-0287

I01 system components of wash/wipe system

Index	Explanation
1	Washer jet, right (with heater)
2	Wiper motor, right
3	Power distribution box, passenger compartment
4	Body Domain Controller (BDC)
5	Rain-light-solar-condensation sensor (RLSBS)
6	Instrument cluster (KOMBI)
7	Steering column switch at steering column switch cluster (SZL)
8	Rear wiper with electric motor

# I01 General Vehicle Electronics

## 5. Wash/wipe System

Index	Explanation
9	Washer fluid level switch
10	Wiper motor, left
11	Washer jet, left (with heater)
12	Electric motor, windshield washer pump



The exact procedure described in the repair instructions must be observed when replacing the wiper motor.

The wiping pattern of the windshield wiper system of the I01 is much different to that of previous BMW vehicles.



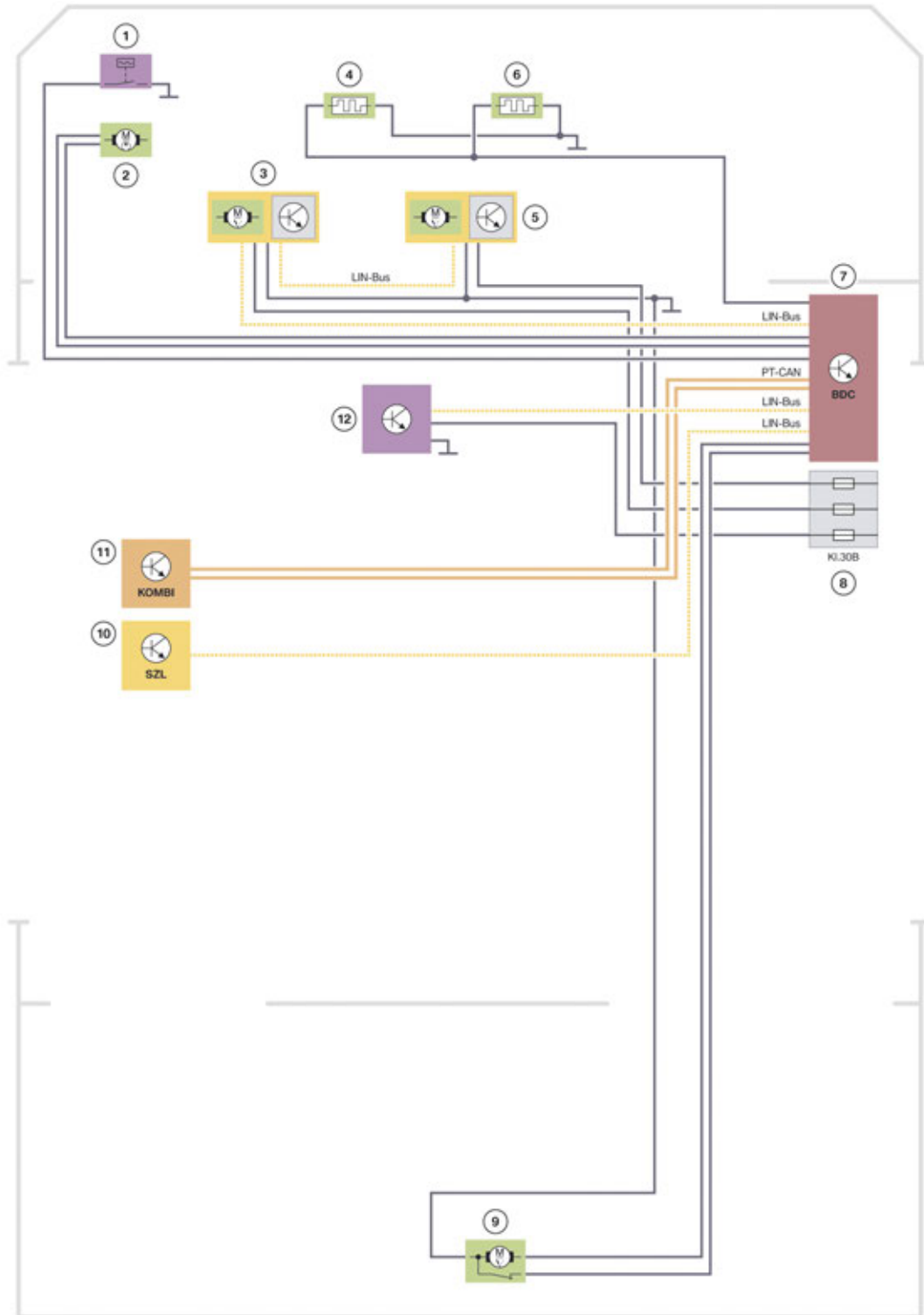
Comparison of wiping pattern of I01 and F30

Index	Explanation
A	Wiping pattern of I01
B	Wiping pattern of F30

# I01 General Vehicle Electronics

## 5. Wash/wipe System

### 5.2. System wiring diagram



System wiring diagram for wash/wipe system of I01

TE12-1003

# I01 General Vehicle Electronics

## 5. Wash/wipe System

Index	Explanation
1	Washer fluid level switch
2	Electric motor, windshield washer pump
3	Wiper motor, left <sup>1</sup> (Master CU)
4	Heated washer jet, left
5	Wiper motor, right
6	Heated washer jet, right
7	Body Domain Controller (BDC)
8	Fuses in the power distribution box in the passenger compartment
9	Wiper motor, rear
10	Steering column switch cluster (SZL)
11	Instrument cluster (KOMBI)
12	Rain-light-solar-condensation sensor

<sup>1</sup>The local interconnect network bus connection for the BDC is always established for the wiper motor on the driver's side (Master Control Unit). A I01 with left-hand drive is shown here.

### 5.3. System components

In the I01 a wiper motor with integrated control unit electronics including two Local Interconnect Network interfaces is used. The wipe request and driving speed is transmitted to the control unit of the wiper motor on the driver's side (master) via Local Interconnect Network by the BDC. Via another local interconnect network bus the master control unit then activates the control unit of the wiper motor on the passenger's side.

The wiper motor is a 12 V reverse motor with a transmission. The control unit, the wiper motor and the transmission form one replaceable unit. This wiper motor unit comprises:

- A permanently excited direct current motor with attached reduction gear
- Control unit electronics with eccentric shaft sensor and suppressor components with attached plug connection.

The control unit in the wiper motor is able to identify the following faults:

- Faults in the control unit electronics
- Short circuits at the motor and sensor system
- Open lines at the motor and sensor system.

The control unit in the wiper motor does not have a fault memory. The fault code entry is done in the Body Domain Controller.



# **I01 General Vehicle Electronics**

## **6. Locking and Security Functions**

There are two distinct systems concerned with vehicle access in the I01:

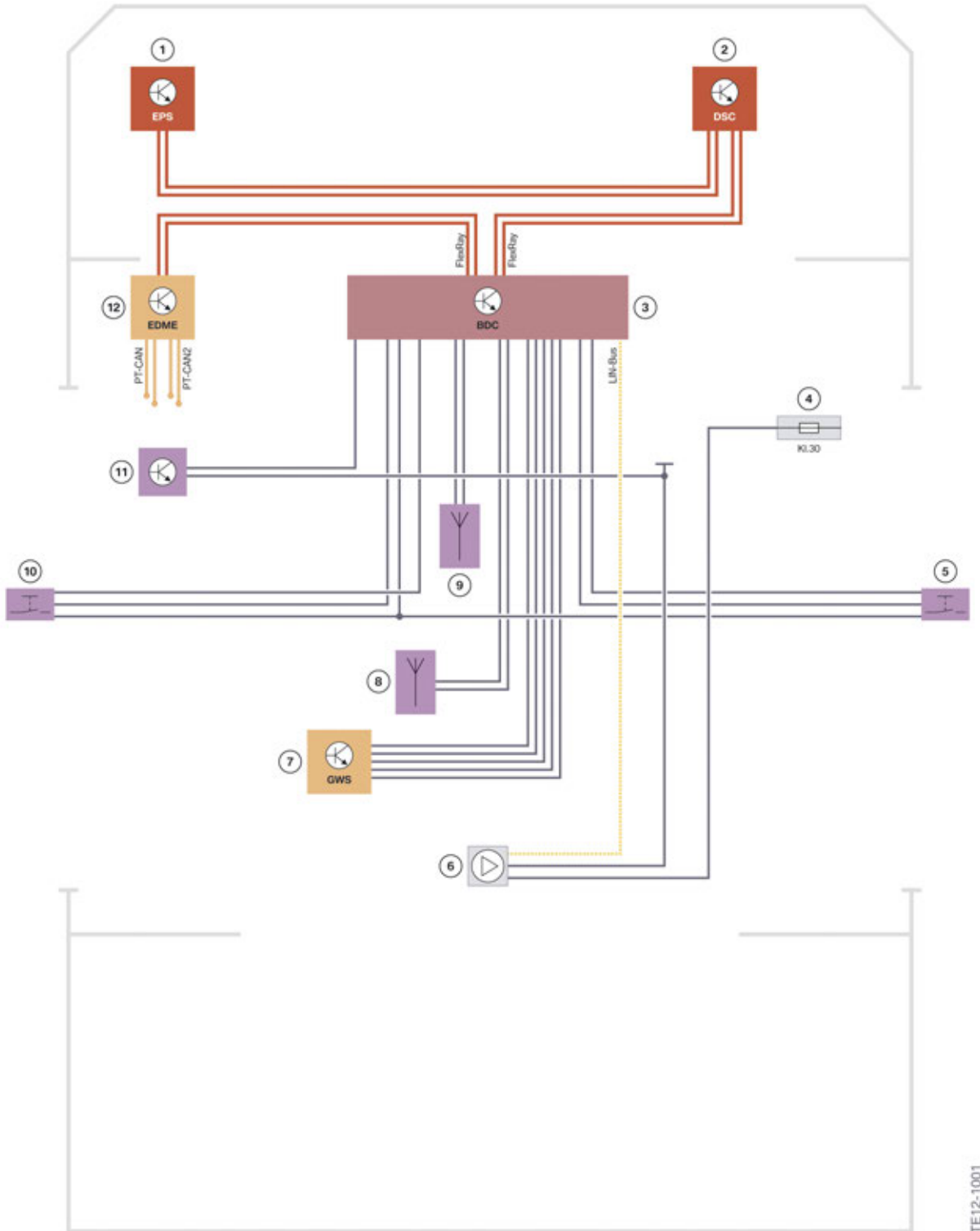
- Basic access, central locking system
- Comfort Access (option 322).

The entire locking and security functions of the I01 is integrated in the BDC.

# I01 General Vehicle Electronics

## 6. Locking and Security Functions

### 6.1. System wiring diagram



TE12-1001

I01 system wiring diagram for locking and security functions

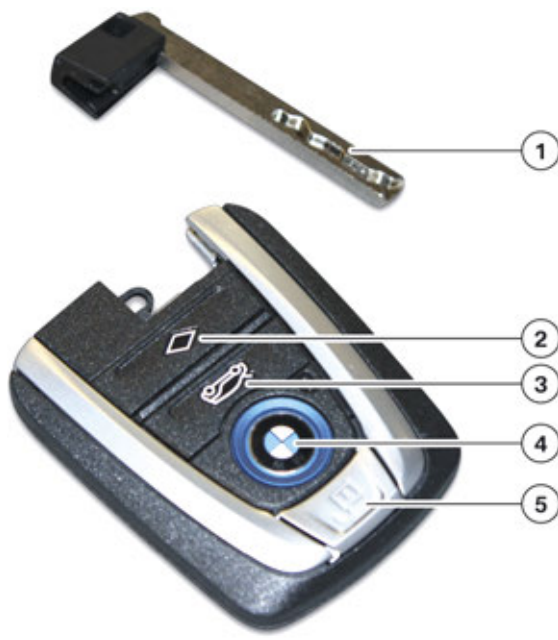
# I01 General Vehicle Electronics

## 6. Locking and Security Functions

Index	Explanation
1	Electronic Power Steering (EPS)
2	Dynamic Stability Control (DSC)
3	Body Domain Controller (BDC)
4	Fuse in the power distribution box in the passenger compartment
5	Button for central locking system in front passenger door
6	Remote control receiver
7	Gear selector switch (GWS)
8	Ring aerial (transponder coil)
9	Interior aerial (front)
10	Button for central locking system in the driver's door
11	Brake light switch
12	Electrical Digital Motor Electronics (EDME)

### 6.2. System components

An ID transmitter with a new design was developed for the I01. The data transfer for the vehicle and for the storage of data on the ID transmitter is the same as for current BMW models.



I01 ID transmitter

TE13-0292

# I01 General Vehicle Electronics

## 6. Locking and Security Functions

Index	Explanation
1	Mechanical key for emergency operation
2	Free 4th button (factory setting is unlocking of tailgate)
3	Unlocking of engine compartment lid
4	Locking
5	Unlocking

### 6.3. Overview of functions

There is no insertion slot installed in the I01. The vehicle can already be started without a key as standard. This function is called "Passive Go" (drive authorization). However, to gain access to the vehicle, it is still necessary to actuate the ID transmitter.

The following locking and security functions are integrated in the I01 in the Body Domain Controller:

- Comfort Access  
The optional equipment Comfort Access contains the "Comfort Entry" and "Comfort Exit" functions. The "Passive Go" function comes as standard.
- Central locking system
- Power window regulators
- Sliding/tilting sunroof
- Terminal control
- Electronic immobilizer.

The locking and security functions of the I01 are based on the CAS functions in the F01 and are described in the "Car Access System F01/F02" training material.

With regard to start enable by the electronic immobilizer (also called Challenge Response), some changes have been made from the F01. What is new is the omission of the CAS bus, because PT-CAN and FlexRay already provide redundancy of data transfer between BDC and EDME.

In addition to the transmission release in the control unit GWS in the I01 there is also a release of the steering via the Electronic Power Steering. The emergency-start function by stopping the ID transmitter at the ring aerial is already known from the F01.

### 6.4. Central locking system

The function of the central locking system of the I01 is based on that of current BMW models. With the introduction of the BDC all relevant functions for the central locking system are handled by one control unit. The function is as follows:

The radio signal from the ID transmitter is received by the remote control receiver.

The signal causes the BDC to activate the central locking system and the interior lighting.

# I01 General Vehicle Electronics

## 6. Locking and Security Functions

The BDC evaluates the status of all door contacts. In this way, for example, the vehicle can be prevented from being locked while the driver's door is open.

The status of the central locking system button is also evaluated by the BDC. The BDC activates the central locking system, depending on the status.

The BDC is responsible for the status recording and activation of the central locking system in the tailgate.

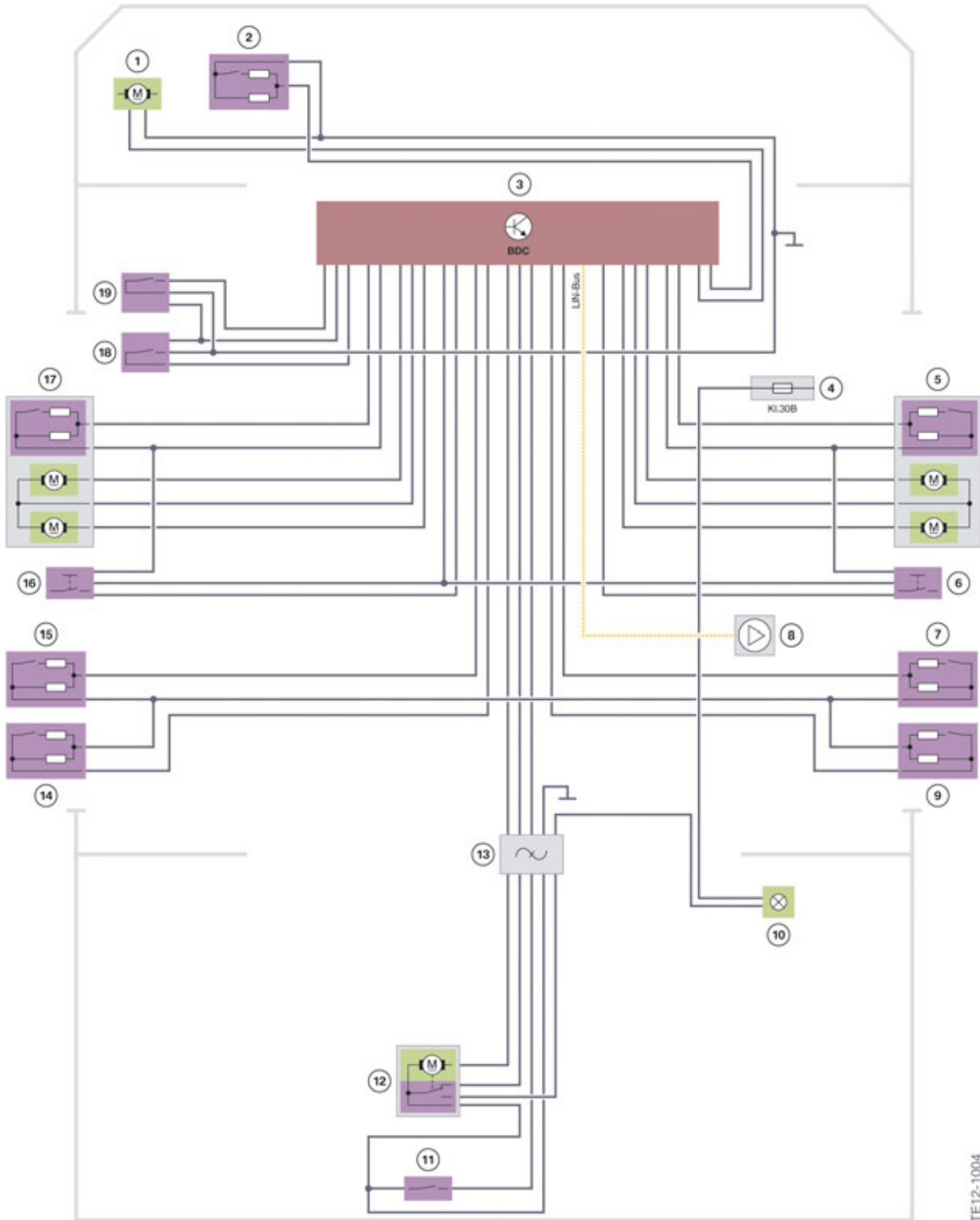
The activation of the unlocking of the engine compartment lid is also the responsibility of the BDC.

The activation of the unlocking of the fuel filler flap in vehicles with range extender is done by the hybrid pressure refueling electronic control unit TFE and not by the central locking system.

# I01 General Vehicle Electronics

## 6. Locking and Security Functions

### 6.4.1. System wiring diagram



I01 system wiring diagram for central locking system

# I01 General Vehicle Electronics

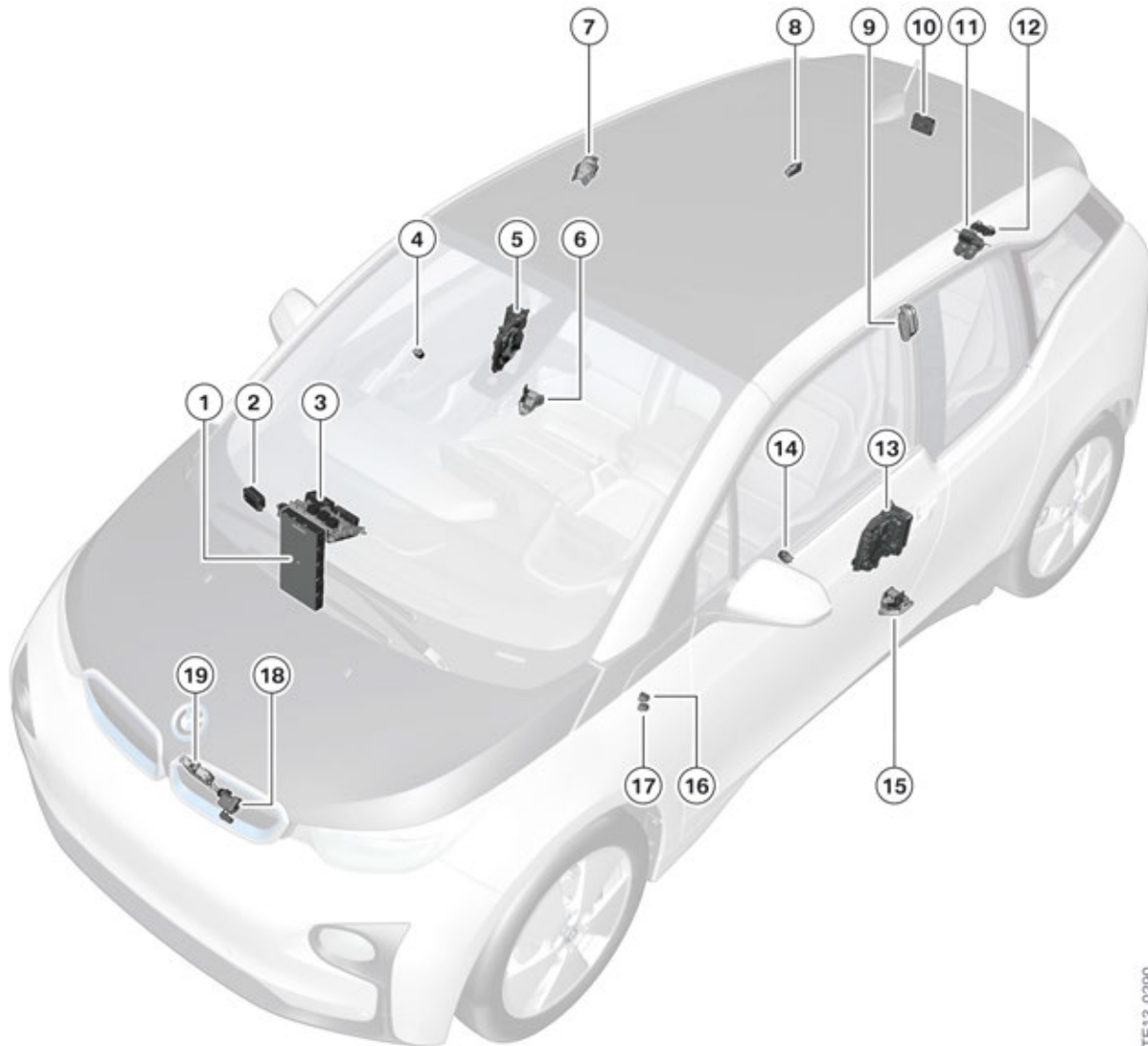
## 6. Locking and Security Functions

<b>Index</b>	<b>Explanation</b>
1	Electric motor for unlocking the engine compartment lid catch
2	Engine compartment lid contact switch in the engine compartment lid catch
3	Body Domain Controller (BDC)
4	Fuse in the power distribution box in the passenger compartment
5	Door contact, central locking system on front passenger's side
6	Button for central locking system in door on front passenger's side (only US version vehicles)
7	Door contact of central locking system for upper lock on rear passenger's side
8	Remote control receiver
9	Door contact of central locking system for lower lock on rear passenger's side
10	Luggage compartment light
11	Tailgate push-button on the outside of the tailgate
12	Tailgate contact with tailgate lock
13	Interference suppression filter
14	Door contact of central locking system for lower lock on rear driver's side
15	Door contact of central locking system for upper lock on rear driver's side
16	Button for central locking system in the door on the front driver's side
17	Door contact, central locking system, driver's side, front
18	Tailgate push-button
19	Button for engine compartment lid

# I01 General Vehicle Electronics

## 6. Locking and Security Functions

### 6.4.2. System components



TE13-0290

I01 system components of central locking system

Index	Explanation
1	Body Domain Controller (BDC)
2	Remote control receiver
3	Power distribution box, passenger compartment
4	Button for central locking system in door on front passenger's side (only US version vehicles)
5	Door contact, central locking system on front passenger's side
6	Door contact of central locking system for lower lock on rear passenger's side
7	Door contact of central locking system for upper lock on rear passenger's side



# I01 General Vehicle Electronics

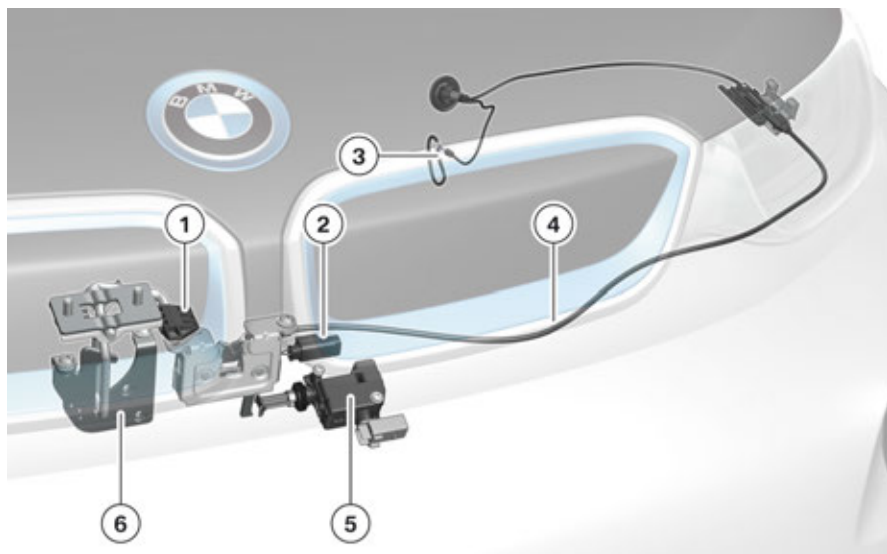
## 6. Locking and Security Functions

Index	Explanation
8	Luggage compartment light
9	Door contact of central locking system for upper lock on rear driver's side
10	Interference suppression filter
11	Tailgate contact with tailgate lock
12	Tailgate push-button on the outside of the tailgate
13	Door contact, central locking system, driver's side, front
14	Button for central locking system in the door on the front driver's side
15	Door contact of central locking system for lower lock on rear driver's side
16	Button for engine compartment lid
17	Tailgate push-button
18	Electric motor for unlocking of engine compartment lid catch
19	Engine compartment lid contact switch in the engine compartment lid catch

The engine compartment lid of the I01 can be unlocked from the passenger compartment using a button at the A-pillar and using the ID transmitter. In each case the unlocking is done electrically. The engine compartment lid can be unlocked in the event of a fault using the emergency release.

A microswitch in the engine compartment lid catch identifies the completely closed engine compartment lid.

During the journey the unlocking of the engine compartment lid is blocked. If the engine compartment lid was unlocked electrically, the retaining hook, as known from other BMW vehicles, must be unlocked from the hook position.



I01 system components of engine compartment lid catch

# I01 General Vehicle Electronics

## 6. Locking and Security Functions

---

Index	Explanation
1	Unlocking of retaining hook
2	Electrical connection at the engine compartment lid catch for microswitch
3	Operation of the emergency release for rear trim panel at A-pillar
4	Bowden cable for emergency release
5	Electric motor for unlocking of engine compartment lid catch
6	Retaining hook

---

### 6.5. Comfort Access

The Comfort Access function is integrated in the BDC.

Comfort Access contains the following functions:

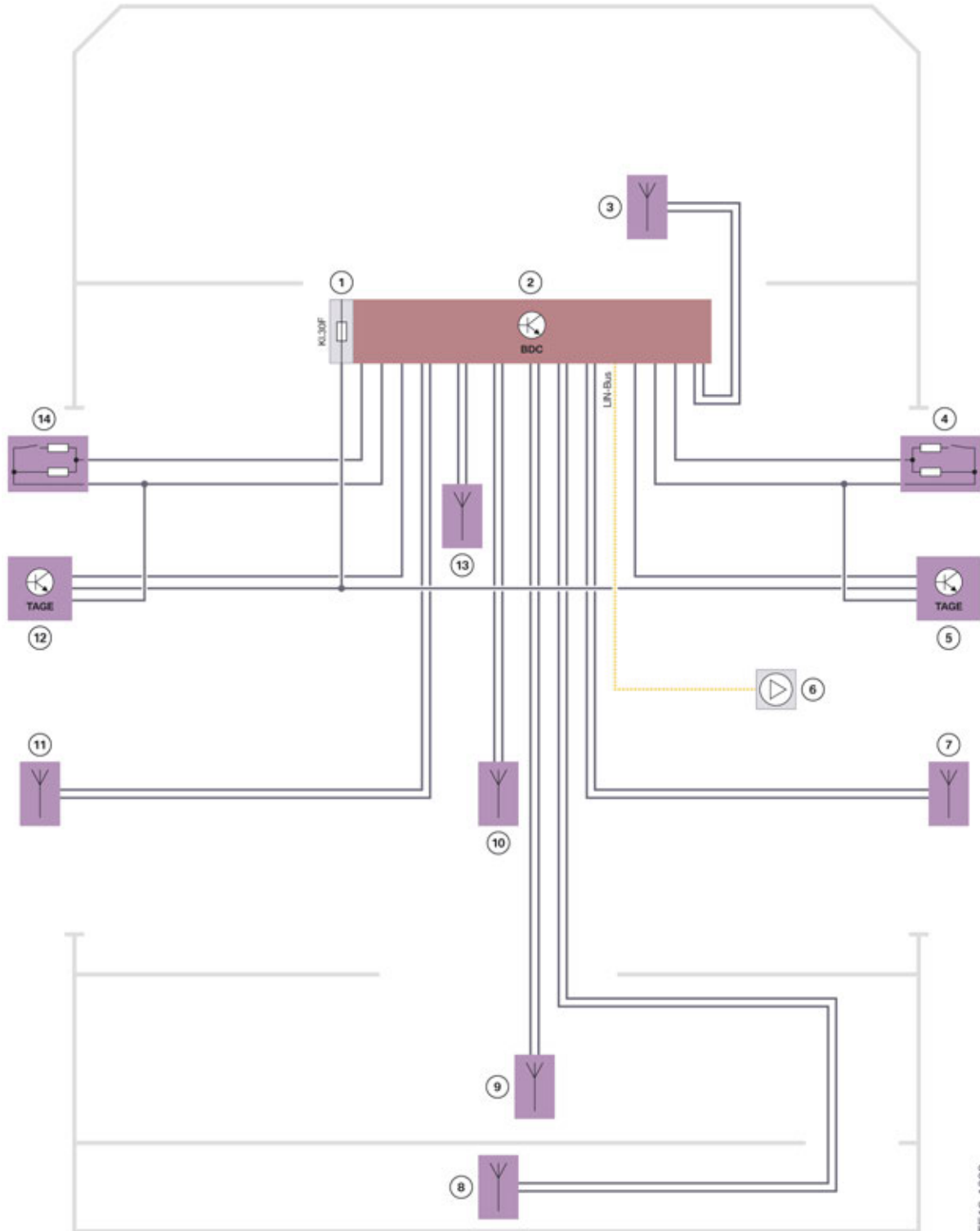
- **Passive Entry (access authorization)**  
facilitates access to the vehicle without active use of the ID transmitter
- **Passive Go (drive authorization)**  
enables the vehicle to be started when there is a valid ID transmitter in the passenger compartment
- **Passive Exit (locking authorization)**  
enables the vehicle to be locked without active use of the ID transmitter.

The components and functionality of Comfort Access are familiar from the current BMW models.

# I01 General Vehicle Electronics

## 6. Locking and Security Functions

### 6.5.1. System wiring diagram



I01 system wiring diagram for Comfort Access

TE12-1002

# I01 General Vehicle Electronics

## 6. Locking and Security Functions

Index	Explanation
1	Fuse in the Body Domain Controller
2	Body Domain Controller
3	antenna for Comfort Access under engine compartment lid
4	Door contact, front passenger's side
5	Outside door handle electronics (TAGE) on front passenger's side
6	Remote control receiver
7	Antenna for Comfort Access on rear right (in right rear door)
8	Comfort Access antenna, bumper, rear
9	Comfort Access aerial, luggage compartment
10	Antenna for Comfort Access passenger compartment, rear
11	Antenna for Comfort Access on rear left (in left rear door)
12	Outside door handle electronics TAGE on driver's side
13	Interior antenna (front)
14	Door contact, driver's side

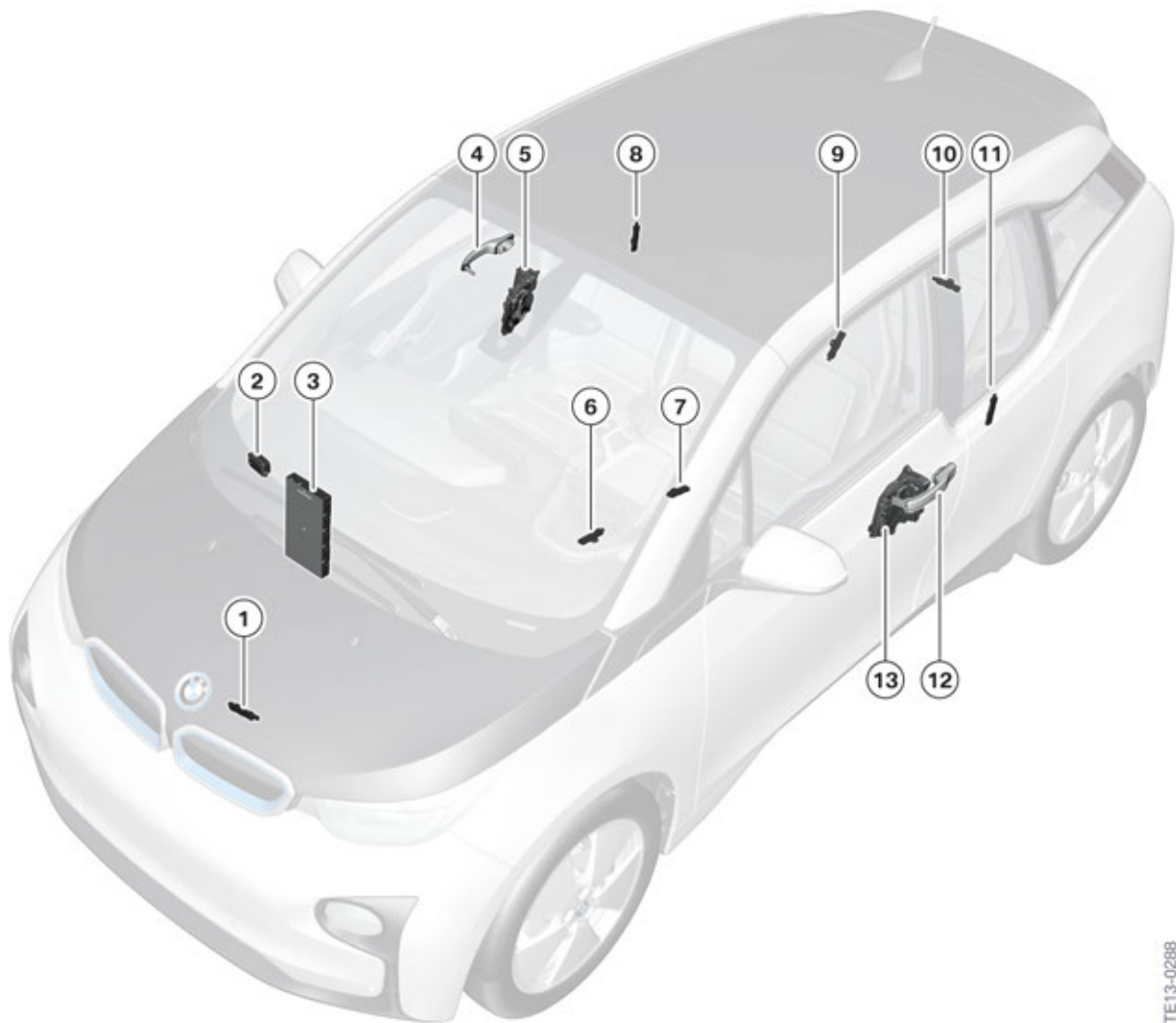
### 6.5.2. System components

For the CA function the BDC activates the antennas for the exterior and passenger compartment.

The outside door handle electronics (TAGE) are also read in by the BDC.

# I01 General Vehicle Electronics

## 6. Locking and Security Functions



TE13-0288

I01 system components of Comfort Access

Index	Explanation
1	Antenna for Comfort Access under engine compartment lid
2	Remote control receiver
3	Body Domain Controller
4	Outside door handle electronics TAGE on front passenger's side
5	Door contact in the door lock, passenger's side
6	Interior antenna (front)
7	Antenna Comfort Access passenger compartment, rear
8	Antenna for Comfort Access, rear right
9	Comfort Access aerial, luggage compartment

# I01 General Vehicle Electronics

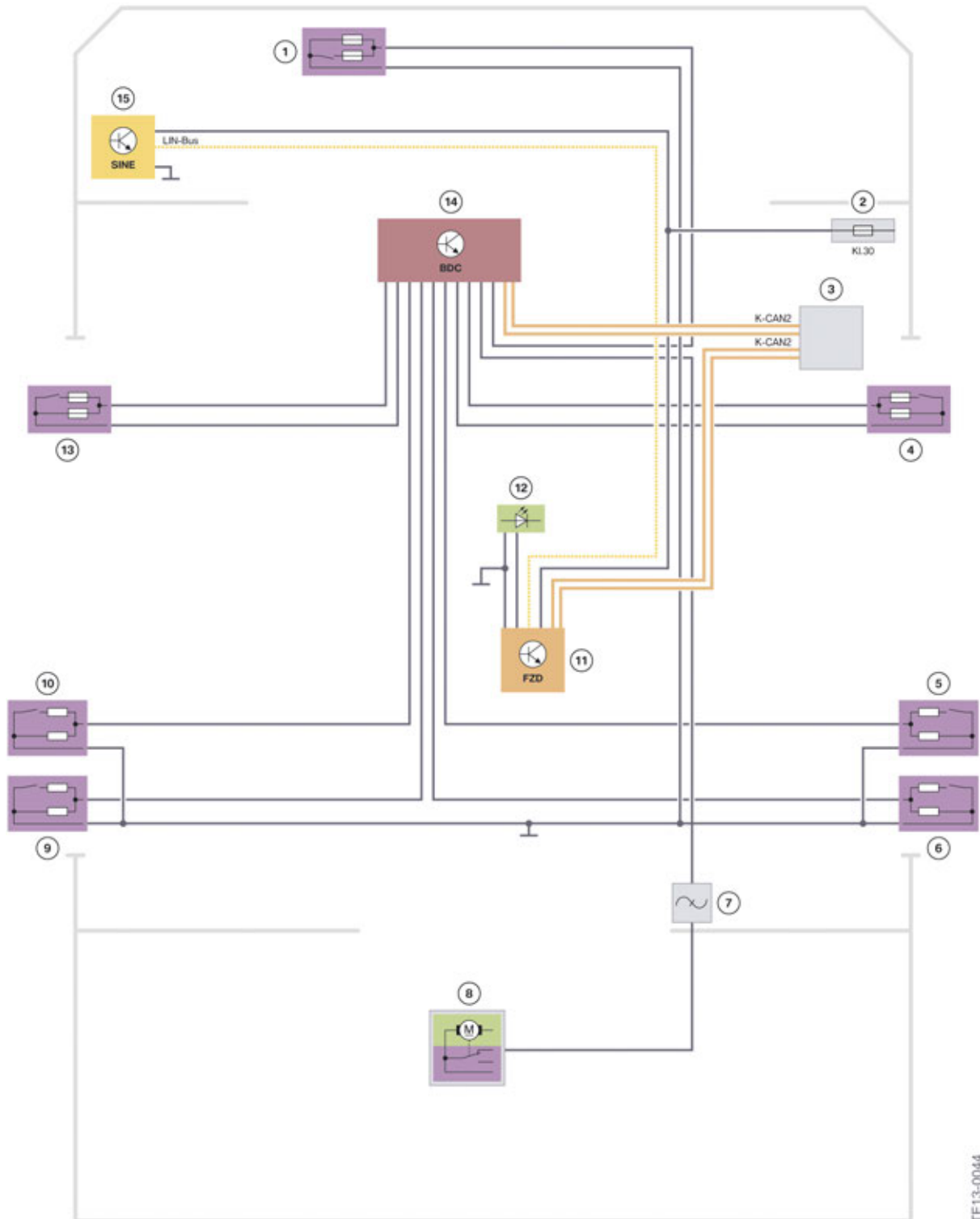
## 6. Locking and Security Functions

<b>Index</b>	<b>Explanation</b>
10	Comfort Access aerial, bumper, rear
11	antenna for Comfort Access, rear left
12	Outside door handle electronics (TAGE) on driver's side
13	Door contact in the door lock, driver's side

# I01 General Vehicle Electronics

## 7. Alarm System

### 7.1. System wiring diagram



System wiring diagram for alarm system

TE13-0044

# I01 General Vehicle Electronics

## 7. Alarm System

Index	Explanation
1	Engine compartment lid contact switch
2	Fuse in the power distribution box in the passenger compartment
3	CAN terminator
4	Door contact, front passenger's side
5	Door contact at top of rear passenger's side
6	Door contact at bottom of rear passenger's side
7	Interference suppression filter
8	Tailgate contact with tailgate lock
9	Door contact at bottom of rear driver's side
10	Door contact at top of rear driver's side
11	Roof function center
12	LED in the inside mirror
13	Door contact, driver's side, front
14	Body Domain Controller
15	Siren with tilt alarm sensor

The alarm system in the I01 is equipped with an ultrasonic interior movement detector for monitoring the passenger compartment. The ultrasonic interior movement detector (USIS) is fully integrated in the roof function center (FZD).

The door contacts, engine compartment lid contact switch and the opening of the tailgate are monitored by the Body Domain Controller. As soon as a status changes, the ultrasonic interior movement detector receives this information via the K-CAN2. In the event of an activated alarm system a siren with tilt alarm sensor is activated by the control unit in the event of a break-in.

The SINE is connected to the FZD via a local interconnect network bus.

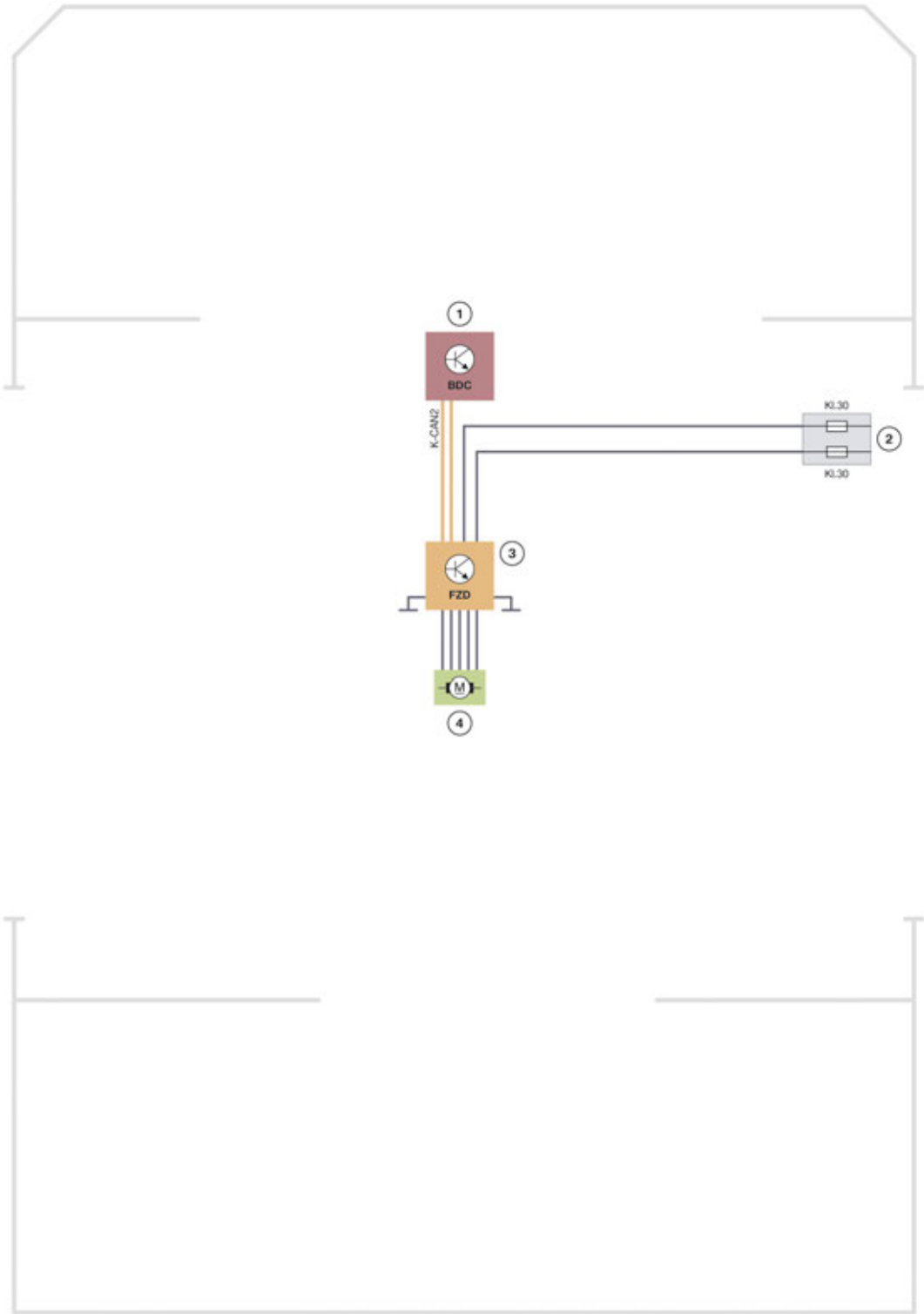
The status of the alarm system is displayed via the LED at the inside mirror.



# I01 General Vehicle Electronics

## 8. Slide/Tilt Sunroof

### 8.1. System wiring diagram



System wiring diagram for slide/tilt sunroof

TE13-0049

# I01 General Vehicle Electronics

## 8. Slide/Tilt Sunroof

---

<b>Index</b>	<b>Explanation</b>
1	Body Domain Controller
2	Fuses in the power distribution box in the passenger compartment
3	Roof function center
4	Electric motor for slide/tilt sunroof

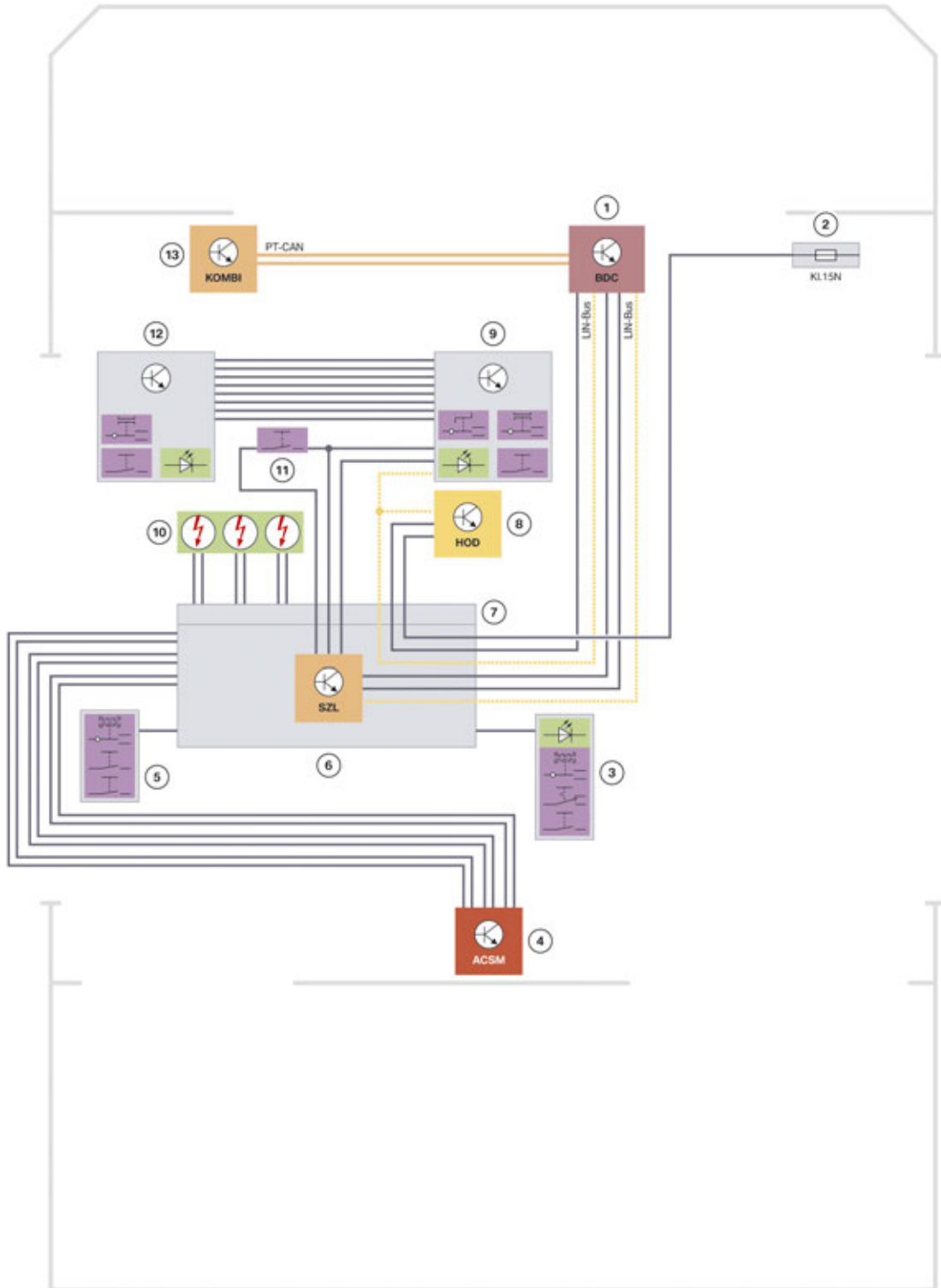
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The control and monitoring of the motor of the slide/tilt sunroof is located in the FZD, as is known from other BMW models.

# I01 General Vehicle Electronics

## 9. Steering Column Switch Cluster

### 9.1. System wiring diagram



System wiring diagram for steering column switch cluster

TE13-0045

# I01 General Vehicle Electronics

## 9. Steering Column Switch Cluster

Index	Explanation
1	Body Domain Controller
2	Fuse in the power distribution box in the passenger compartment
3	Drop arm, right
4	Crash Safety Module (ACSM)
5	Drop arm, left
6	Steering column switch cluster
7	Clock spring
8	Touch detection HOD (hands of device) <sup>1</sup>
9	Switch block, radio/telephone
10	Driver's airbag
11	Horn button
12	Switch block for cruise control
13	Instrument cluster

<sup>1</sup>For the optional equipment traffic jam assistant a capacitive sensor with relevant electronics HOD (hands of device) detects whether the steering wheel is touched.

All signals of the buttons and switches of the multifunction steering wheel (MFL) and the steering column switch cluster (SZL) are transmitted via Local Interconnect Network to the Body Domain Controller. There are 2 LIN lines from the steering column switch cluster (SZL) to the Body Domain Controller:

- LIN from SZL to BDC and
- LIN from MFL through SZL looped through to BDC.

# I01 General Vehicle Electronics

## 10. Exterior Mirrors

The following exterior mirror variants are possible in the I01:

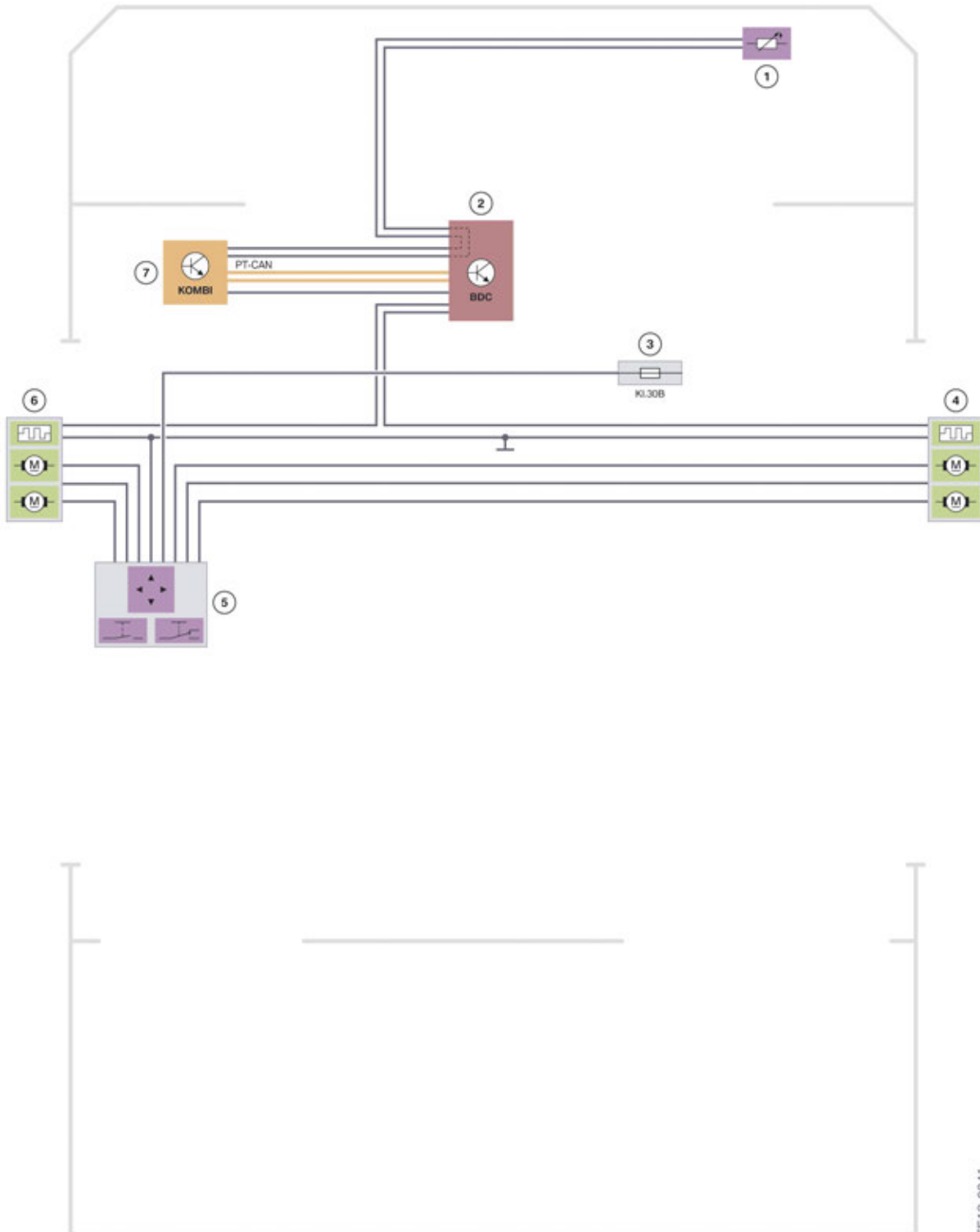
- Without LIN bus connection
- With LIN bus connection.

# I01 General Vehicle Electronics

## 10. Exterior Mirrors

### 10.1. System wiring diagram

#### 10.1.1. Exterior mirror without LIN bus connection



# I01 General Vehicle Electronics

## 10. Exterior Mirrors

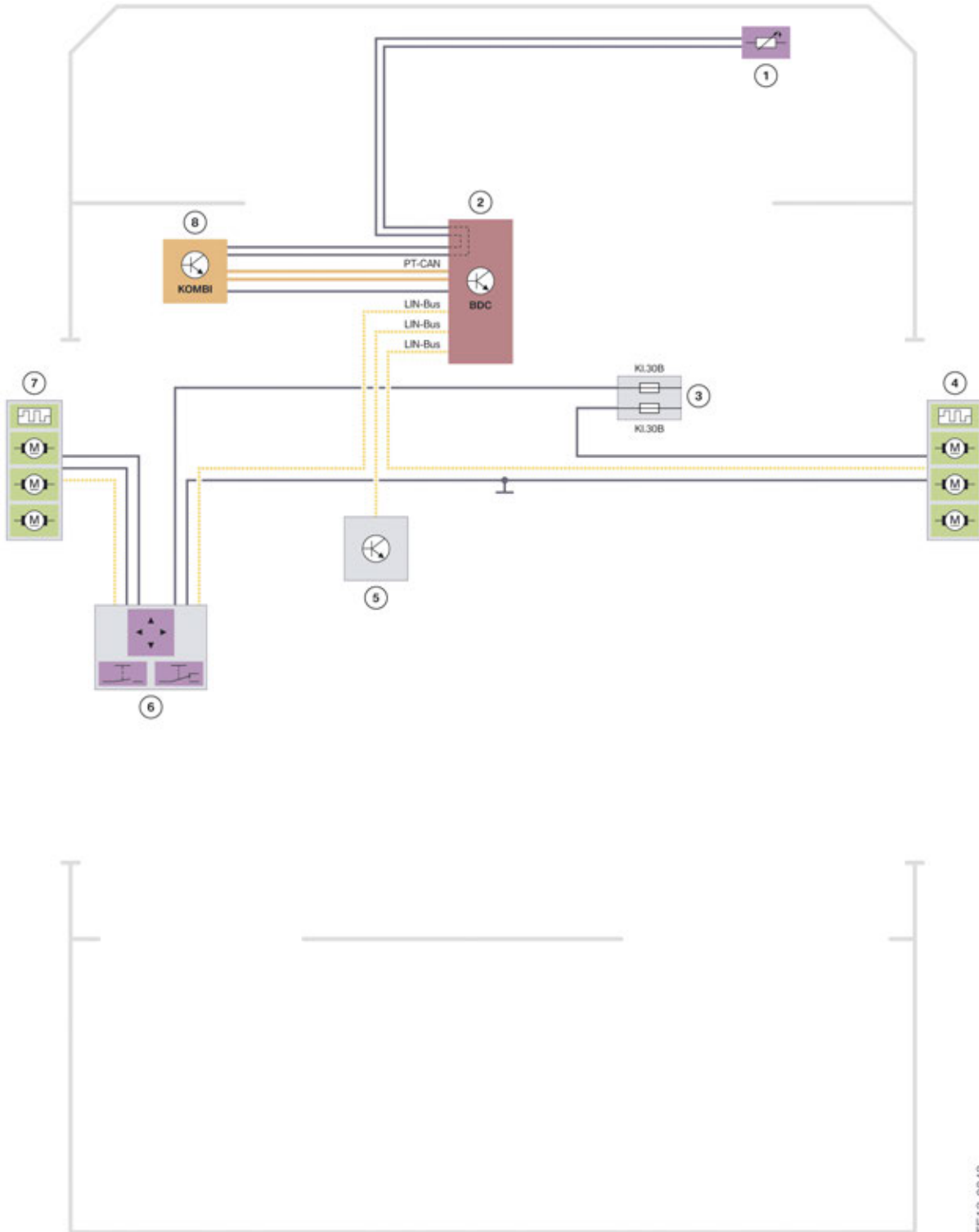
Index	Explanation
1	Outside temperature sensor
2	Body Domain Controller
3	Fuse in the power distribution box in the passenger compartment
4	Exterior mirror, front passenger's side
5	Switch block, driver's door
6	Exterior mirror, driver's side
7	Instrument cluster

The electric motors of the exterior mirror are activated directly using the mirror adjustment switch. The instrument cluster receives the value of the ambient temperature from the outside temperature sensor and makes this available to the Body Domain Controller. The control and the output stages for the heating of the exterior mirror are located in the Body Domain Controller. The control of the heater output is dependent on the ambient temperature and the switch position of the driving experience switch.

# I01 General Vehicle Electronics

## 10. Exterior Mirrors

### 10.1.2. Exterior mirror with LIN bus connection



System wiring diagram for exterior mirror, high equipment

TE13-0042



# I01 General Vehicle Electronics

## 10. Exterior Mirrors

Index	Explanation
1	Outside temperature sensor
2	Body Domain Controller
3	Fuses in the power distribution box in the passenger compartment
4	Exterior mirror, front passenger's side
5	Electronics in the electrochromic inside mirror
6	Switch block, driver's door
7	Exterior mirror, driver's side
8	Instrument cluster

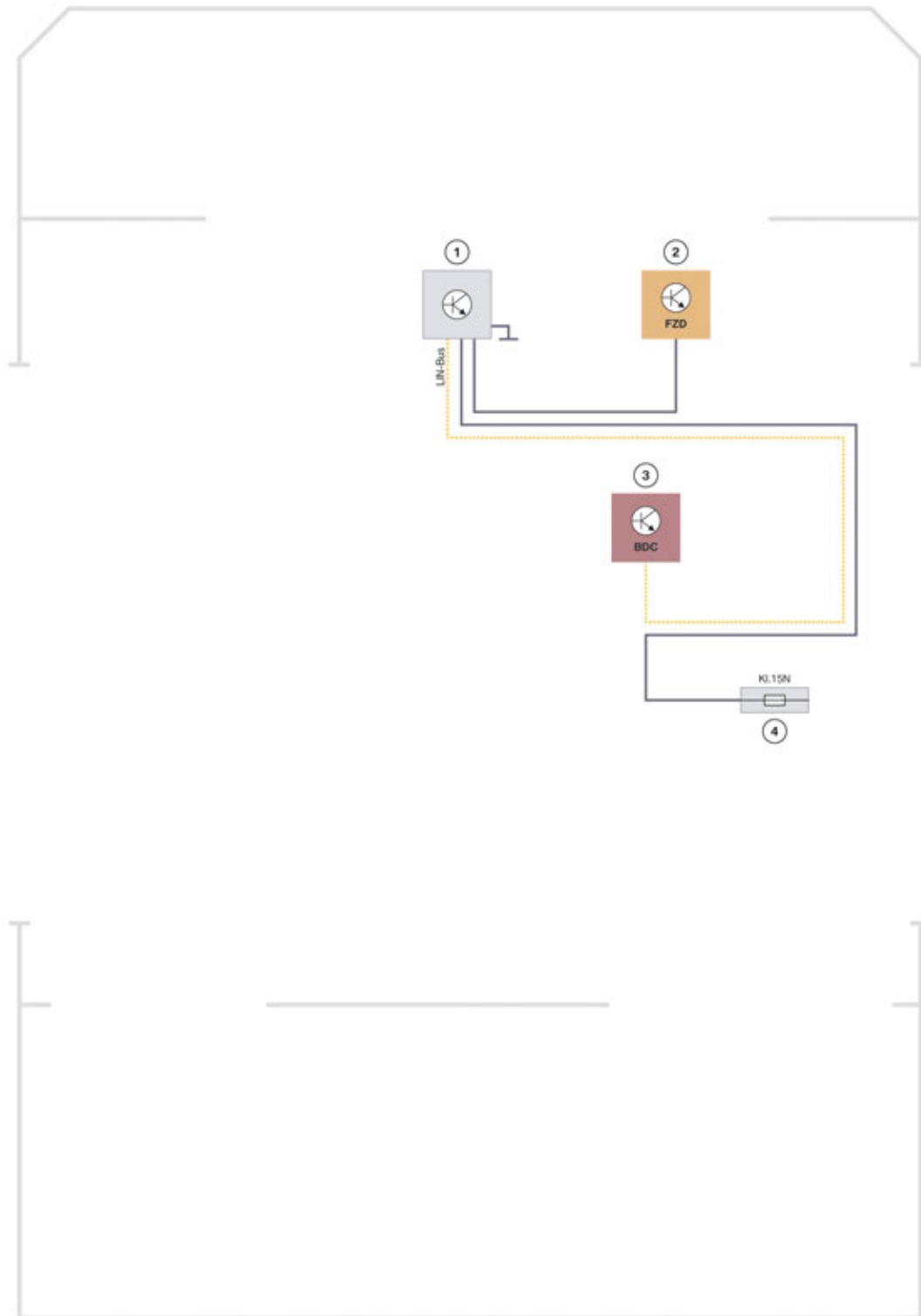
The instrument cluster receives the value of the ambient temperature from the outside temperature sensor and makes this available via the PT-CAN. The Body Domain Controller evaluates the signal and triggers the activation of the mirror heating via the local interconnect network bus. The control of the heater output is dependent on the ambient temperature and the switch position of the driving experience switch.

The mirror servomotors are activated by the mirror electronics. The request for adjusting the exterior mirror is received by the mirror electronics via the local interconnect network bus.

# I01 General Vehicle Electronics

## 11. Inside Mirror

### 11.1. System wiring diagram



TE13-0040

System wiring diagram for automatically dipping interior mirror

# I01 General Vehicle Electronics

## 11. Inside Mirror

<b>Index</b>	<b>Explanation</b>
1	Electronics in the electrochromic inside mirror
2	Roof function center
3	Body Domain Controller
4	Fuse in the power distribution box in the passenger compartment

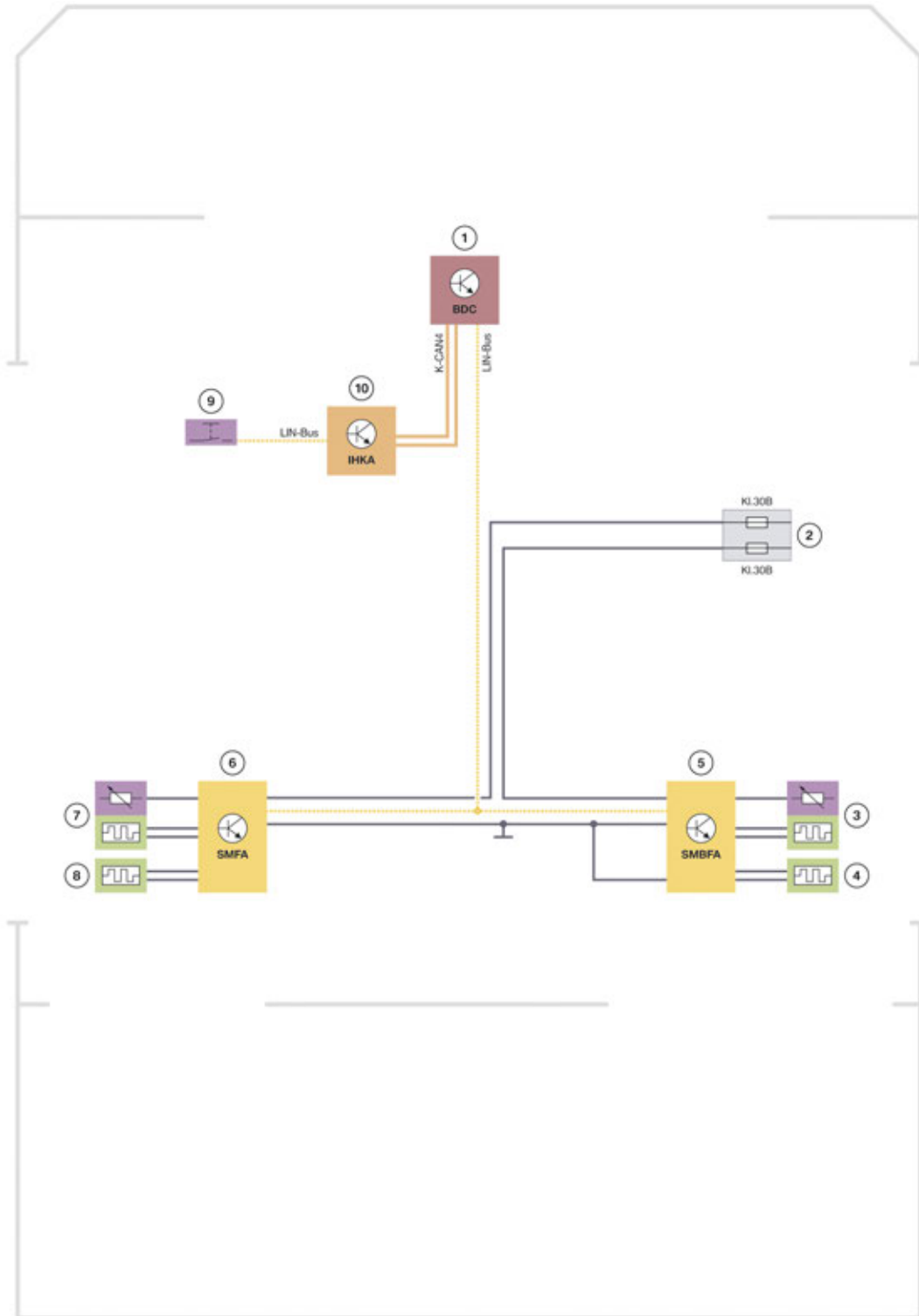
In a vehicle with an automatically dipping inside mirror, the inside mirror is connected to the BDC via local interconnect network bus.

The LED for the alarm system is located at the inside mirror.

# I01 General Vehicle Electronics

## 12. Seat Heating

### 12.1. System wiring diagram



TE13-0039

System wiring diagram for seat heating

# I01 General Vehicle Electronics

## 12. Seat Heating

Index	Explanation
1	Body Domain Controller
2	Fuses in the power distribution box in the passenger compartment
3	Seat heating pad on passenger's side, seat surface
4	Seat heating pad on passenger's side, backrest
5	Front passenger seat module
6	Driver's seat module
7	Seat heating pad on driver's side, seat surface
8	Seat heating pad on driver's side, backrest
9	Heating - A/C control panel
10	Integrated automatic heating / air-conditioning system

Signal path for seat heating:

- The buttons for the seat heating are read in by the control panel of the heating and air-conditioning system.
- The control unit for the IHKA or integrated heating / air-conditioning regulation sends the local interconnect network bus information on the K-CAN4
- The BDC receives this information and transmits the corresponding switch-on stage to the respective seat module via local interconnect network bus.
- The seat module activates the heating mats with the corresponding power.

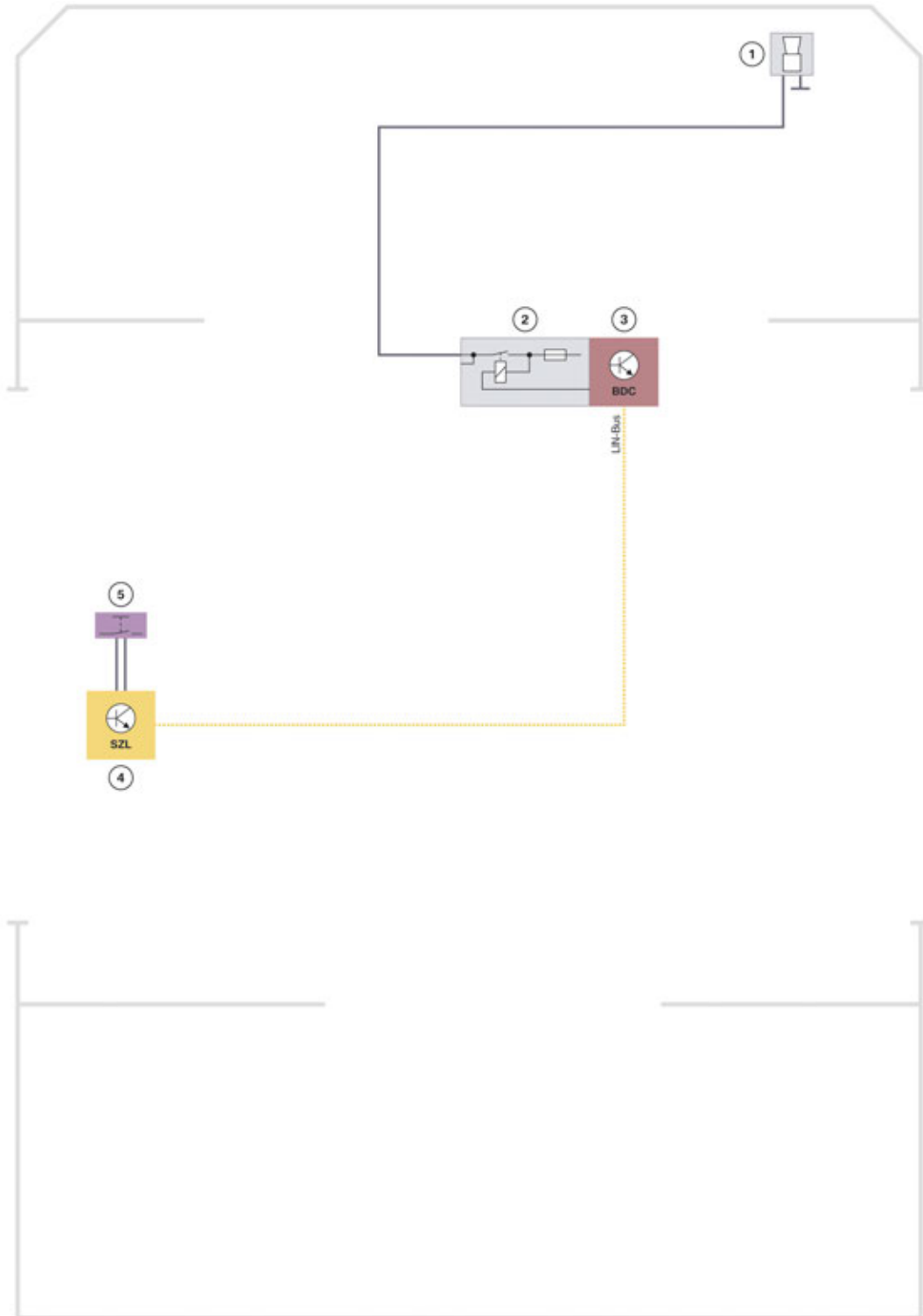
The control of the heater output is dependent on:

- the switch-on stage of the seat heating and
- the switch position of the driving experience switch.

# I01 General Vehicle Electronics

## 13. Horn

### 13.1. System wiring diagram



System wiring diagram for the horn

TE13-0043

# I01 General Vehicle Electronics

## 13. Horn

Index	Explanation
1	Fanfare
2	Relay and fuse <sub>1</sub>
3	Body Domain Controller
4	Steering column switch cluster
5	Horn button

<sub>1</sub>The relay for the horn is located above the power distribution box in the passenger compartment. The fuse for the horn is located in the Body Domain Controller.

Signal path of horn:

- The horn button is read in by the steering column switch cluster SZL.
- The SZL sends the information via the local interconnect network bus to the Body Domain Controller
- The Body Domain Controller evaluates the information and activates the relay for the horn.



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